

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

CHAPTER 6

FISH AND WILDLIFE RESOURCES

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CHAPTER 6

FISH AND WILDLIFE RESOURCES

SECTION 1: FISHERIES MANAGEMENT

6100. GOALS AND OBJECTIVES. Goals established for the Marine Corps Base, Quantico (MCB), Virginia fisheries management program are to (1) maintain self-sustaining fish populations to provide quality, sustained fishing for the recreational enjoyment of sport fishermen (Figure 6-1), and (2) perpetuate all native species of aquatic fauna that may occur on the Base (Swihart 1980). Accomplishment of these objectives will consist of a combination of the following practices (USFWS 1987): (a) regulation of the creel size and length of fish allowed to be harvested; (b) enforcing Virginia and MCB fishing regulations; (c) physical manipulations; e.g., water level manipulations, placement of fish shelters; (d) biological manipulations; e.g., supplemental stocking or species introductions; and (e) protection of water quality through control of both point and non-point source pollution.

6101. FISHERIES HABITAT RESOURCES. Surface water resources of the MCB are shown at Figure 2-2. The four primary watersheds, Aquia Creek, Cedar Run (Occoquan Creek watershed), Chopawamsic Creek, and Quantico Creek all drain into the Potomac River, a tributary of the Chesapeake Bay. All watersheds contain various native non-game fish species. Nine impoundments ranging in size from 1 to 477 acres support self-sustaining warm water fisheries. The lower Chopawamsic Creek expands into a shallow 377-acre tidal open water riverine wetland that is an important nursery area for Potomac River fishes. The Base owns about 4.0 miles of shoreline along the Potomac River and 2.0 miles of shoreline along the tidal portion of Quantico Creek. Water open for recreational fishing is shown at Appendix B, page 2-11.

1. Lunga Reservoir

a. Lunga reservoir is the largest and most popular body of water on the Base. It contains 477 acres with a watershed of 6,880 acres and water storage capacity of 1.75 billion gallons. It provides the secondary water supply for the Base water treatment plant. The Marine Corps Community Services Division (MCCS) operates Lunga Park, which includes a boat house, campsites, picnic areas, restroom facilities, boat rentals, and a boat launching ramp. Self-sustaining populations of largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), chain pickerel (*Esox niger*), channel catfish (*Ictalurus punctatus*), black crappie (*Pomoxis nigromaculatus*), white perch (*Morone americana*), warmouth (*L. gulosus*), and brown bullhead (*L. nebulosus*) (USFWS 1985) are present in Lunga. Striped bass were stocked in Lunga during the 1970's and early 1980's. That practice was discontinued as regional fisheries management emphasis was shifted away from inland impoundments to put full effort into restoration of striped bass in the Chesapeake Bay. Also, habitat at Lunga may be

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limiting for striped bass, thus impacting recovery of this species. Redear (*L. microlophus*) were stocked from 1987-1989 to establish this sunfish in Lunga. The redear attains greater size in this region than bluegill. Walleye (*Stizostedion vitreum*) were stocked in 1990-1992 concurrent with the construction of a rock reef in an effort to establish a viable population. Annual stocking was resumed in 1996 and has continued to the present time. Walleye have reached about 8 pounds in size but no successful reproduction has been recorded. Based on recent fishing reports and trap netting studies (Oct 2005, unpub. data), a self-sustaining yellow perch (*Perca flavescens*) fishery has become established from an unknown source.

b. Dissolved Oxygen Studies. In 1989, field studies were conducted to determine the dissolved oxygen and temperature profile. The primary purpose of the study was to determine the potential suitability of Lunga reservoir to support walleye, a cool water fish. Results showed that the reservoir becomes thermally stratified and oxygen deficient (less than 3 ppm) at depths greater than 3 meters from June - September, inclusive. A thermocline was present from 6-12 feet deep. Despite this stratification, DGIF fisheries biologists concluded that the reservoir was not significantly different from other Virginia reservoirs supporting walleye and that stocking should be attempted.

c. Submerged Aquatic Vegetation. Late in 2005, it was determined that much of the benthic area was carpeted by musk-grass or stonewort (*Chara spp.*). The musk-grass resembles a vascular plant and probably causes no harm other than interfering with fishing. Bladderwort (*Utricularia spp.*) was found in some of the shallower regions of the reservoir.

2. Breckinridge Reservoir

a. Breckinridge Reservoir is located in Training Area 6 on the main stem of Chopawamsic Creek 5.2 miles inland from the Potomac River. This 47-acre reservoir is the principal water supply for MCB and has 12,902 acres of watershed. The lake was drained and the dam repaired in 1965. It was subsequently restocked with 10,000 largemouth bass, 50,000 bluegill, and 5,000 channel catfish. Channel catfish were also stocked in 1984. A gravel boating ramp is accessible from New Breckinridge Road located off of MCB-1.

b. The Breckinridge tailrace is characterized by six small staircase impoundments that were constructed in 1967-68 in an attempt to create suitable trout habitats. Concrete weirs with flashboard gates regulate water levels in these pools. Three of the weirs have been badly breached by floodwaters and are in disrepair.

c. Dissolved Oxygen Studies. In 1989, field studies were conducted to determine the dissolved oxygen and temperature profile for Breckinridge Reservoir. The reservoir becomes stratified from late June - September and forms a thermocline from 3-9 feet deep. Breckinridge appears to be slightly cooler than Lunga and stratifies a

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little later in the spring. Breckinridge is a very steep sided reservoir with depths up to 45' at the dam.

d. Submerged Aquatic Vegetation. In September 2005, it was determined that hydrilla had formed a dense wall of vegetation along all shorelines to a depth of about 8 feet. Because of the steep-sided nature of the reservoir, hydrilla was largely restricted to a narrow band along the shoreline.

3. Dalton Pond. Dalton Pond is a 16.4-acre pond with a watershed of about 1,280 acres. It is located in Training Area 13 and has limited access from MCB-3. Maximum water depth is about 9 feet. The fish community includes largemouth bass, bluegill, redear sunfish, black crappie and catfish. The water control gate at this reservoir is stuck in a closed position so that drawdowns can only be accomplished by pumping. Hydrilla is well established. In an August, 2005 survey, all areas of the pond shallower than 8 feet (about 70% of the surface area) contained a dense growth of hydrilla.

4. R-6 Pond. This pond was constructed in Training Area 9B at Range 6 for the purpose of conducting training exercises but is used infrequently for this purpose. It is a 6.6 acre pond with a 200 acre watershed. The pond contains largemouth bass and bluegill. It has an improved gravel access road that is kept locked due to the pond's location near an impact area. Patrons need to check in at Range Control for access instructions.

5. Barrett Pond. This is a one-acre pond located behind the parade deck at Camp Barrett. It is spring fed and has a 4-acre watershed. In 1966 the pond was drained, cleaned, rotenoned; rank vegetation was cut along the banks; and it was restocked with channel catfish. It was restocked with catfish again in 1972. It has not been managed for fish in recent years due to its limitations concerning size and ability to support public access.

6. Upshur Pond. Upshur Pond is a one-acre impoundment with a watershed of 33 acres located in Training Area 17A. In 1968 it was drained and cleaned, the drain system was repaired, and the banks were cut and replanted to grass to retard erosion and silting. When the pond was refilled it developed a leak. There is currently no detectable leak in the dam. However, the pond does not hold adequate water through the summer months and the water level often drops to less than 3 feet. Bluegills occur in the pond but a self-sustaining fishery has not been developed.

7. Nolan H. Gray Reservoir. This impoundment is a 1.8 acre body of water that formerly was used as a holding pond for the Base water supply. It is located approximately 1.5 miles below Breckinridge Reservoir and is fed by Chopawamsic Creek. The reservoir capacity is greatly reduced and water depth only averages about 2 feet due to sediment deposits. A study was conducted in 1992 to design a project to reclaim some of the lost fish habitat. Using dragline, it was estimated that about 0.6 acres of the pond could be dredged, attaining a maximum depth of 6 feet. A handicapped accessible fishing dock was

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constructed along the shoreline to provide accessible trout fishing. No action has been taken yet to dredge this reservoir. It is filling in and creating a shallow water and emergent wetland. Hydrilla was an abundant SAV in 2000.

8. Buffalo Pond. Buffalo Pond is a 4.1 acre pond located in Training Area 4. Access to the pond is permitted only from the Officer Candidate School area via Engineer Road. Largemouth bass, crappie and bluegill are present in this pond. Fingerling channel catfish were stocked in 1998-1999.

9. Smith Lake. This 220 acre reservoir is managed by Stafford County for potable water supplies and has a capacity of two billion gallons. A portion of the reservoir is located within the boundaries of the Base. A MCB fishing license is required to fish from the shoreline within MCB boundaries. Stafford County has no public access facilities to this reservoir; public fishing and boating access to the reservoir is provided by MCB on Smith Lake Road. The reservoir supports a recreational fishery for largemouth bass, channel catfish, walleye, crappie, bluegill and redear.

10. Trout Stream. Approximately 3.0 miles of Chopawamsic Creek is managed as a put-and-take fishery, with rainbow trout (*Onchorhynchus mykiss*), brown trout (*Salmo trutta*) and brook trout (*Salvelinus fontinalis*) being stocked in the spring. At the upper stocked portion of Middle Branch, Chopawamsic Creek, a 50 meter section of the stream, Secon Pool, is reserved for children 12 years old and younger. Restroom facilities are provided at this area.

11. Tidal Waters. Tidal waters include 3.9 miles of shoreline bordering the Potomac River, 2.0 miles of shoreline bordering Quantico Creek, and a 377 acre estuary at the mouth of Chopawamsic Creek. The estuary serves as a nursery area for fish and shellfish occurring in the Potomac River. In the spring, runs of herring (*Alosa* spp.) can be seen ascending the stream at the head of the estuary (Swihart 1980). Fish species reported for tidal Chopawamsic Creek include blueback herring (*A. aestivalis*), alewife (*A. pseudoharengus*), American shad (*A. sapidissima*), gizzard shad (*Dorosoma cepedianum*), white perch, yellow perch, catfish, carp, gar and pickerel. *Hydrilla verticillata* (hydrilla) invaded the tidal Potomac River and Chopawamsic Creek in 1989. Since then an excellent largemouth bass fishery has developed. A boat launch ramp for tidal Chopawamsic Creek and the Potomac River is located at the Officer Candidate School. Canoeing access to the upper tidal portion is available at the Wildlife Viewing Area. Boating access to Quantico Creek and Possum Point is available at the Hospital Point boat ramp. An accessible fishing facility, the Joe Foxx Shoreline Pier, was constructed at the Marine Corps Air Facility.

6102. FISHING REGULATIONS. Military personnel and civilians are allowed access to the fishing areas at MCB. Specific regulations for fishing on Base are provided at Appendix B, Chapter 2.

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6103. FISHERIES MANAGEMENT PROGRAM

1. Technical Assistance. Both the U.S. Fish and Wildlife Service (USFWS) and the Virginia Department of Game and Inland Fisheries (DGIF) have provided technical fisheries assistance, professional advice, and fish stocking to MCB. The providing office for the USFWS is the Office of Fisheries Assistance, Gloucester Point, Virginia, and for the DGIF, is the Fisheries Division regional office at Fredericksburg, Virginia.

2. Management Practices. Fisheries management at MCB was initiated in 1951. Past management has been concerned primarily with maintaining self-sustaining largemouth bass/bluegill fisheries and a put-and-take trout fishery. Water management included pond reclamation, pond construction, fertilization, bank clearing, stocking, building access roads, cataloguing streams, conducting creel surveys, and restocking.

a. Fertilization. A fertilization program was established to increase primary productivity, prevent or retard the growth of submerged weeds, and enhance fish growth and carrying capacity. Ponds were scheduled for treatment with a 20-20-5 fishpond fertilizer at the rate of one 40-lb (18-kg) bag per acre per application. From 3 to 6 applications a year were required to maintain desired plankton blooms (MCCDC 1975). This fertilization program was discontinued prior to 1983.

b. Bank and Clearance. Bank clearance was conducted to improve the appearance of ponds and allow more fishing space along the bank. Banks were cleared of underbrush; tree stands were thinned to open, park like stands; and grass was planted to the water's edge, where possible, to improve aesthetics and prevent siltation. Banks are not cleared along streams. Instead, these riparian areas have been protected as much as possible from disturbances.

c. Sampling. Sampling of managed waters is scheduled intermittently to provide water quality and fish production data. Sampling has been accomplished in most years using one or more of the following: seines, gill nets, trap nets, and electroshocking. Most recently, the DGIF and USFWS have begun to summarize sampling results in standardized terms such as relative stocking density of preferred sized fish (RSD-P) and catch per unit effort of preferred sized fish (CPE-P).

d. Stocking. Initial stocking of ponds was considered necessary to obtain the proper species and populations desired. Additional stocking has been conducted based on sampling data and upon the availability of fish at the hatcheries. All stocking has been done per recommendations provided by the USFWS and the DGIF.

e. Access. All weather paved or gravel access roads have been constructed at all of the MCB fishing areas with the exception of Upshur Pond and R-6 Pond. Gravel boat launch ramps are located at Brekinridge Reservoir, Dalton Pond, and the Beaverdam Run access to

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Smith Lake. The Breckinridge Reservoir boat ramp becomes dry during summer drought periods and boat launching becomes difficult or impossible. Concrete ramps are available at Lunga Reservoir, OCS, Hospital Point, and the Aquia Creek launch at Smith Lake.

f. Habitat manipulations. Habitat manipulations include regulating water levels, sedimentation control, introduction or control of aquatic plants, and placement of fish structures. Numerous fish structures have been built and placed in Lunga and Breckinridge Reservoirs, and Dalton Pond, by the Conservation Volunteer Program.

g. Water Quality Protection. The protection of water quality by the control and reduction of point and non-point pollution sources is addressed through a variety of soil and water conservation practices (Chapter 4).

6104. STUDIES AND SURVEYS

1. 1981 Trout Stocking Report. An evaluation of the put-and-take trout stocking program was conducted by the USFWS (1981). The survey consisted of creel censuses conducted at (1) Middle Branch Chopawamsic Creek - Secon Pool Area, and (2) Chopawamsic Creek - Main Stem, Breckinridge Reservoir tailrace to Gray's Reservoir Dam. Results of the survey at MCB are summarized below.

a. The major factors affecting a self-sustaining trout population were determined to be infertile water, high water temperatures, and low water flow during the summer.

b. At Secon Pool, fishing pressure averaged 56 hours per mile per day. The overall catch rate of planted marked trout was 0.49 fish per hour, with estimated returns to the creel (determined from regression analysis) of 60% and 65%.

c. At Chopawamsic Creek - Main Stem, fishing pressure averaged 113.37 angler hours per mile per day. However, 62% of the total fishing pressure occurred during the first three days. The estimated return to the creel of planted marked trout (from regression analysis) was 80%. The average creel per hour of marked trout was 0.42 fish.

d. The overall mean catch rate and return to the creel were within the limits as stated in the standards.

2. Impoundment Surveys. The largest warm water impoundments, Lunga Reservoir and Smith Lake, are normally sampled annually to monitor fish growth and population trends. Smaller reservoirs and ponds, Breckinridge, R-6, Dalton, and Buffalo, are sampled on a more intermittent basis to ascertain fish population trends. A summary of results and recommendations from these surveys includes the following.

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a. 1986 Electroshocking

(1) Lunga Reservoir, Breckinridge Reservoir, and Dalton Pond were studied in 1986. Sampling results indicated that the size distribution of largemouth bass 7.8 in. (200 mm) and longer was below the acceptable distribution of balanced bass populations. In all samples there was a surplus of bass 7.8 to 11.7 in. (200 to 299 mm) in total length, but the young to adult ratio was acceptable for each sample. The bluegill and black crappie samples from Lunga Reservoir all were composed of acceptable proportions of quality-size fish. However, there were relatively small proportions of the larger preferred-size fish present in samples of bluegill and black crappie. The Breckinridge Reservoir largemouth bass sample results indicated that the population was balanced; however, the sample size was small. The bluegill sample results indicated a population with an undesirably low level of quality-size fish. The black crappie sample was too small for interpretation. Data from Dalton Pond showed that the largemouth bass population may be substantial, but catchable-size fish were rare. Samples of redear sunfish indicated that a good population of this species was developing (USFWS 1987). Breckinridge Reservoir had the most balanced bass population, with a higher percentage of fish occurring in the size class greater than 12 inches. Only Lunga Reservoir had bluegill that exceeded 8 inches in length.

(2) As a result of the 1986 survey, a base-wide slot limit was established in 1987 for largemouth bass. The regulation requires that bass between 12 and 15 inches long (30.5 and 38.1 cm) be released. Bass smaller or larger than the slot size could be retained up to the creel limit set statewide by the DGIF.

(3) In Lunga Reservoir, many of the fish captured during the survey were associated with brush structures placed in the reservoir. It appeared that the greatest number of fish captured were associated with large structures rather than small, randomly scattered units. Thus, it was recommended that larger structure be built and placed in designated areas. It was recommended that each structure have a 200 to 400 sq ft (18.6 to 37.2 sq m) base dimension. They should be placed in shallow water at depths of 5 to 7 ft (1.5 to 2.1 m) and in deep water at depths down to 20 ft (6.1 m). Each structure should consist of as much vertical profile as possible, and the total area of reef placement should not exceed 0.25% of the surface area of the reservoir at normal pool elevation. It was also recommended that fish shelters be placed in Breckinridge Reservoir using the same technique.

b. 1990 Electrofishing. Daytime electrofishing surveys were used to evaluate the current sportfish populations. Scale samples were collected from 100 fish for each of the three major game species: largemouth bass, bluegill and crappie. The 1990 surveys produced a composite sample of 10 species and indicated no major problems with the sportfish populations. Growth of largemouth bass was above the state average for all age classes except for the first year-class. Bluegill and crappie appeared to grow at a rate equal to the state average.

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c. Walleye. In 1990, the DGIF was asked to provide assistance to establish a walleye fishery. DGIF agreed to stock walleye for three consecutive years beginning in 1990 and then cease stocking efforts to assess reproductive success in the following years. MCB constructed a gravel spawning reef for walleye in 1992.

d. 1992 Trap Netting. In 1992, the DGIF conducted trap netting in Lunga Reservoir to monitor for walleye survival. Although no walleye were detected, the CPE-P for white perch was extremely high. Other species contributing substantially to the capture numbers and weights were brown bullhead and channel catfish.

e. DGIF conducted additional trap, gill net and electroshocking from 1993 - 2005 to monitor the Lunga walleye introduction, largemouth bass populations, and the response of fish to the Smith Lake expansion in 1998. Walleye up to 20 inches were detected in both Lunga and Smith, indicating survival of at least one age class. No reproduction of walleye has yet been detected. Bass populations at Lunga Reservoir and Smith Lake are similar to populations in other Stafford County lakes. Unfortunately the CPE-P and RSD-P is in the lower half of reservoirs monitored by DGIF in northern Virginia. It is believed that the acidic and infertile soils of Stafford County contribute to waters of low conductivity and poor fish production capability. DGIF concludes that the Lunga bass population is stable and of moderate quality compared to other District waters (Odenkirk 2001). They encourage anglers to catch white perch to help prevent overpopulation.

f. The MCB Quantico Fish, Wildlife and Agronomy Section collected trap net samples in fall 2005 and spring 2006 to conduct black crappie age and growth studies using otoliths for age determination. Evaluation of the data is still in progress. Captures of other species incidental to that work suggest that a substantial yellow perch fishery has developed in Lunga Reservoir, that bluegill populations in both Lunga and Breckinridge Reservoirs exhibit many quality-sized fish, and that Lunga has a good population of quality redear sunfish.

3. Stream Fisheries Evaluation

a. An inventory of fish distribution and habitat quality in MCB streams was conducted in 1988 by the USFWS. Water chemistry parameters were also measured at sample sites. A total of 23 species were captured from 18 stations located in Beaverdam Run, Chopawamsic Creek and tributaries of Cedar Run. No rare or endangered fish species were detected. Habitat conditions among the stations varied. In most cases riparian vegetation was not disturbed and stream banks were stable. Most sedimentation present in the streams appeared to have originated from activities away from the streams, e.g., tank crossings. Beaver dams and manmade check dams trapped sediment and appeared to enhance water quality immediately downstream of these structures (USFWS 1988).

b. In 1998 and 1999, George Mason University used EPA Rapid Bioassessment Protocol V (Plafkin et al. 1989) to evaluate the fish

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communities and habitat conditions in Base streams. Forty fish species were identified, including all 23 previously identified in the USFWS survey (Appendix C). Based on the Index of Biotic Integrity (IBI) computed from this study, the quality of almost all MCB streams was "very good and perhaps the best found in northern Virginia." Together with Quantico Creek in Prince William Forest Park, these streams seem to be the best reference sites available in this area (Kelso et. al. 2000)."

4. Natural Heritage Surveys. In 1991, all MCB watersheds were surveyed for the presence of rare and endangered species (VDCR 1992). The dwarfwedge mussel (*Alismadonta heterodon*) was located in Aquia Creek near the mouth of Cannon Creek bordering MCB Training Area 7A. Further discussion of this federally listed endangered species is provided in Chapter 7.

6105. MANAGEMENT RECOMMENDATIONS

1. Coordinate DGIF access for:

a. Sampling of impoundments to maintain a database on water quality, centrarchid and ictalurid populations. Establish database record of specific measurement parameters, i.e., PSD-P, CPE-P, etc., that may show population trends over time.

b. Monitoring of walleye survival and reproduction at Lunga Reservoir.

c. Walleye stocking at Lunga.

2. Continue put-and-take trout fishing program in Chopawamsic Creek. Install information kiosks at stream entry points.

3. Establish a delayed harvest trout fishing program on Base.

4. Continue to replenish fish habitat structures in Lunga and Brekinridge Reservoirs and Dalton Pond.

5. Maintain public access at Smith Lake: maintain road right-of-way, parking areas, and docks. Coordinate fisheries management program with the DGIF and Stafford County.

6. Monitor pond water control structures and spillways for beaver blockages and take action as necessary to control beaver-related damage.

7. Install and maintain identification signs and regulatory information at fishing areas.

8. Maintain road right-of-way and access to the current launch at Brekinridge Reservoir and install an information kiosk.

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9. Control non-point sedimentation pollution of streams by ensuring that Best Management Practices (BMP's) are used at all land disturbing project locations. Restore and revegetate damaged training lands and improve stream crossings where erosion is a problem (Chapter 4). Implement a Nutrient Management Plan per Chesapeake Bay Program guidelines.

10. Enforce all Virginia and MCB fishing regulations and issue citations and/or suspensions for violations of those regulations. Control off-road vehicle traffic in the Chopawamsic Creek fishing area and adjacent training areas 6B and 6C.

11. Maintain year-round MCB fishing license sales program and continue to offer the 5-day trip license as well as the annual license. License fees will be established per current MCB directives.

12. Clear pond dams of encroaching woody vegetation.

13. Inspect and maintain walkway across the Dalton Pond spillway.

14. Remove or repair weir structures on Chopawamsic Creek below Breckinridge Reservoir. In the mean time, make annual inspections and install/remove flashboards to control water levels during trout stocking season.

15. Dredge Gray's Reservoir adjacent to north shoreline to improve fisheries habitat and fishing recreation. Grade and rock the parking area and install kiosk for posting of fishing information. Rock the access trail along Chopawamsic Creek upstream from Gray's Reservoir to provide handicapped access to the trout fishing area.

16. Improve Potomac River boating access by completing construction of a new boat ramp at Hospital Point.

17. Conduct a fisheries creel survey to estimate amount of fishing effort and catch rates at Lunga Reservoir.

18. Complete Submerged Aquatic Vegetation (SAV) surveys in all water bodies and determine the need for controls. If grass carp are recommended for control, complete NEPA documentation prior to any stocking.

19. Complete an age and growth study for primary game fish species in Lunga, Breckinridge and Smith Reservoirs.

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a.



b.



c.



d.

Figure 6-1.—Fisheries resources: a. Lunga walleye; b. Buoy marker for fish structure; c. gill-net sampling; d. volunteers deploy weighted trees for fish structures.

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CHAPTER 6

SECTION 2

TERRESTRIAL HABITAT MANAGEMENT

6200. GOALS AND OBJECTIVES. The management objective is to support and enhance the perpetuation of the animal and plant species native to the Quantico area. This section focuses on the vegetation management within forest and grassland habitats at MCB. Chapter 6, Sections 4-8, and Chapter 7, provide descriptions of the habitat requirements for some of the game, furbearer, nongame, threatened and endangered species found at MCB to provide examples of the range of habitat conditions required. It is not feasible to expect to create optimum conditions for every species within each management unit, i.e., training area or forest compartment. Some species in the mid-Atlantic region are adapted to a variety of habitat conditions that are produced within a landscape of scattered patch disturbances while other species are very specialized. This plan identifies land management zones based on land usage that can be managed as fire-maintained grasslands, managed forestland with patch disturbances, and mature forestland. It is believed that these management regimes will provide the early, mixed and late successional habitat necessary to support biodiversity in the mid-Atlantic region.

6201. HISTORICAL PERSPECTIVE

1. Virginia is located along an ecological transition zone between the fire-maintained pine ecosystems to the south and the hardwood forests to the north. It is reasonable to believe that fire historically played a significant role in the ecology of the MCB land area and the diversity of species that occupy the land. Accounts of early naturalists suggest that Native Americans in the Mid-Atlantic states used fire to maintain grasslands and open forest understories. It is only in the last century that fire suppression resources became available and the influence of fire in the landscape was diminished. Fleming et. al. (2000) noted that it is only on military lands in Virginia where "frequent incendiary fires approximate pre-settlement fire regimes and maintain specialized habitat condition and vegetation assemblages."

2. Diseases and invasive species have also altered the Quantico landscape. A few remaining stems of American chestnut continue to grow at Quantico as a reminder that this species was once a significant part of the forest community. Non-native plants such as tall fescue (*Festuca sp.*) and autumn olive (*Eleagnus unbellata*) were introduced for conservation purposes during the latter half of the twentieth century but are now unwelcome. The gypsy moth has caused significant forest defoliation at Quantico and will probably continue to have an effect on forest age and composition.

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6202. TERRESTRIAL HABITAT RESOURCES

1. Terrestrial habitat resources, described in Chapter 2, comprise about 94% of MCB lands, and forests comprise about 90% of the terrestrial habitat. The suitability of these upland habitats to support different wildlife species is related to the biological requirements of each species for water, space, vegetation structure and nutrition. Training areas, forests, urban areas, and grasslands all contribute to the habitat resources at MCB (Figure 6-2). Forested lands are grouped into four primary habitat types: hard mast producing hardwoods (HMHD), mixed pine-hardwoods (PHWD), non-mast producing hardwoods (NMHD), and conifers (CONI). Grasslands are categorized as fire-maintained grasslands; native grass, scrub and seedlings; cultivated legume/tall grass pastures; cultivated small grain fields; and managed turfgrasses (Table 2-1).
2. Abandoned fields and cutover forestland at MCB normally revegetate rapidly in a predictable sequence known as secondary plant succession. Initially, various annual grasses and forbs flourish on the site. By the third year, the native perennial grass, *Andropogon virginicus* (broomsedge), will be the dominant ground cover. Within two more years, a forest cover will begin to develop with Virginia pine seedlings dominating in most old-field situations. This "old field" pine will gradually thin itself by natural mortality and by 50 years of age, oaks, hickories and beech will have become established. As the pines thin further due to wind throw and heart rot diseases, an eastern deciduous hardwood forest will replace the pine. American beech is believed to be the climax species that will eventually replace oak as the dominant species.
3. Some species, such as quail, rabbits, blue grosbeaks, and common yellowthroats thrive during the early successional stage dominated by grasses, tree seedlings, and brushy thickets. The pileated woodpecker and barred owl, on the other hand, prefer dense mature forests with numerous large trees and snags. Generalist species, such as the white-tailed deer, appear capable of surviving in almost any mixture of vegetation types, but achieve larger body and antler size when large quantities of high quality forage such as agricultural crops and hard mast (acorns, nuts) are available. All of these seral habitat stages from grassland to mature forest provide essential life requisites for maintaining native biodiversity.
4. Management Units. Hunting (training area) boundaries, shown at Appendix B, Figure 3-3, delineate basic land management units at MCB. Military exercises, hunting recreation, and other activities are assigned to these specific areas as a means to control the safe and coordinated use of the MCB land area. Training areas are further subdivided into forest management compartments used for forest management planning (see Chapter 5 Forest Resources). Forest compartments are subdivided into forest stands of similar age and species composition that represent individual management units. The timber stand coverage in the MCB Geographic Information System provides the basic cover type map for the installation and provides the habitat acreage data at Table 2-1.

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5. Forest Age Distribution. Forest age has a significant affect on habitat quality. Older forest stands produce large trees that provide nesting cavities for a large guild of cavity using species. Scattered dead trees (snags) and decaying logs are normal parts of forest ecosystems and provide habitat for various invertebrate and vertebrate species. Older trees produce mast crops that are an important energy source, especially during winter. Young stands have important habitat values also. Species such as woodcock and ruffed grouse prefer young forest stands characterized by a high density of seedling and sapling stems. Young forests produce a large quantity of forage (Banker and Stauffer 1994) and provide important escape cover.

6203. HABITAT REQUIREMENTS. During the development of the MCB INRMP completed in 1997, the U.S. Army Corps of Engineers conducted a literature review of life histories and habitat requirements for some species native to Quantico. Those findings are condensed in Chapter 6, Sections 4-8, and are further summarized at Table 6-1 to describe habitat management recommendations for some terrestrial species and groups of species (guilds) found at MCB. Basic habitat requirements can usually be related to specific vegetation successional stages, i.e., early successional grasslands and scrub-shrub woodlands; mid-successional woodlands; and late successional woodlands of mast-producing hardwoods. The ecological perspective of this plan is to match habitat management actions to land use zones in a way that supports military training mission, fire management, watershed protection, outdoor recreation, and other multiple-use land management programs.

6204. HABITAT MANAGEMENT ACTIONS

1. Where military use of incendiary devices is high (such as range impact areas), a prescribed burning program is needed to reduce fuel levels to control the severity of wildfires set by military training and is described at paragraph 5602. Because frequent fire also creates unique grassland communities (Fleming 2000), fire management also serves as an important tool for maintaining unique ecological communities. In urban areas and protected watersheds where disturbances such as fire and logging may be neither practical nor permissible, the maintenance of mature forest stands to provide optimum habitat for cavity nesting species can be emphasized. Figures 5-1 and 6-3 identify land-use zones that affect wildlife and forest management activities.

a. The Fully Manageable Zone (1) is where access and management actions are not limited by live munitions, unexploded ordnance (duds), and populated buildings. A broad range of silvicultural and wildlife management actions can be considered for use in this zone.

b. The Limited Access Management Zone (2) is comprised of land areas where access is limited due to factors such as live fire surface danger zones (SDZ), traffic congestion, recreation areas, and developed areas. Areas impinged upon by SDZ are off-limits when the

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ranges are "hot." The areas are accessible during periods when the ranges are cold. A broad range of natural resource management and recreation programs such as hunting, mowing, planting, and firewood gathering are feasible as long as they can be scheduled and carried out on days when the ranges are cold. Actions taking weeks or months, such as commercial forest harvest contracts, are not excluded but are difficult to implement due to the time constraints.

c. The Special Conditions/Restricted Zones (3-6) are comprised of DUD areas, tenant lands, developed lands and fenced lands, where natural resources management actions are very limited. In these areas, practices to control forest pests, protect watersheds and water quality, reduce animal damage, and provide public natural history education programs are emphasized whereas large-scale programs to harvest natural resources are generally restricted.

2. Forest Management

a. The habitat management program takes interest in the long-term development of the forest community with regard to age distribution of forest stands and interspersions of different forest types as primary indicators of habitat suitability for wildlife. Some of the primary forest management actions planned to occur in the management zones are summarized below. Chapter 5, paragraph 5404, provides a detailed description of the silvicultural systems proposed for use.

b. Zone 1. Forests will generally be managed on a commercial even-aged rotation of 50 years for pine and 100 years for hardwood forests. Some uneven-aged management in hardwoods will be practiced along riparian zones and within some timber stands depending upon forest age distribution, wildlife habitat needs, and military training requirements within a forest compartment. Current and future predicted forest habitat age-class distribution in Zone 1 would result in a forest comprised of various aged conifer and mast-producing hardwood stands. This mosaic would create many high-contrast edges per unit area and would be supportive of a wide diversity of forest birds and small mammals (Penhollow and Stauffer 2000; Williams and Stauffer 2000).

c. Zone 2. Forest stands on the perimeter of this zone may be harvested on an opportunistic basis during periods that the land is accessible using standard silvicultural guidelines. Because access is unpredictable, it is not likely that a sustained yield management plan can be executed. Some timber stands within the interior of the zone will likely never be accessible for harvest and can be expected to grow into mature hardwood stands unless disrupted by catastrophic events. Forest interior species are expected to thrive in this zone. Fire, storms and insect damage and logging along the perimeter are expected to create some early successional habitat.

d. Zones 3-4. In these zones, commercial timber harvests are expected to take place only to clear land for construction purposes, salvage timber following natural disasters such as storm and insect damage, and remove hazardous trees. In the absence of either

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commercial logging or natural disasters, the forest age structure will continually increase until the majority of the forest exceeds 100 years of age.

3. Non-forested Habitat Management

a. Over 5,500 acres of open non-forested habitat exists at MCB. Nearly one-half (2,609) of that acreage is associated with improved grounds, which include housing areas, administrative buildings and grounds, parade decks, rifle ranges and recreation areas. The remaining open acreage includes semi-developed grounds that are maintained primarily for military training, utility right-of-ways, and wildlife openings. Some of these grounds remain open due to frequent burning caused by high explosive munitions. The majority of the semi-developed grounds either incidentally or through active management provide wildlife habitat in addition to military training sites. These grounds are maintained in grassland/shrub vegetation by agronomic, mowing and prescribed burning management actions. Some improved grounds, such as parade fields, athletic fields, golf course, and rifle ranges provide considerable wildlife forage incidental to their primary purpose. The use of native and non-invasive species for Base landscape plantings is required (see Chapter 3).

b. Managed Openings. Wildlife management goals for managing permanent openings are: to maintain a high-protein forage cover for white-tailed deer; to maintain early successional fields of native grasses and forbs to provide food, cover and brood habitat for small game (quail, dove, rabbits); to provide brood and year-round foraging habitat for wild turkeys; and to provide old field/edge habitat preferred by numerous non-game species. Insectivorous birds and bats actively seek out plantings to feed on the large number of insects attracted to the green plants. When designed and managed for diversity, openings can have a complex vegetative structure (e.g., clumps of woody vegetation, wolf trees (poorly formed trees that have low economic value but provide important habitat for wildlife), snags, stumps, hollow logs, and brush piles) that will provide habitat for a variety of animals (Giles 1978, Anderson 1979). In addition, managed openings are multi-purpose clearings that serve as landing zones and support other military training functions. Tables and maps identifying managed openings at MCB are provided at Appendix C.

c. Conservation Plantings

(1) Currently, about 130-150 acres are cultivated annually with warm season (spring) and cool season (fall) plantings. Warm season plantings normally consist of millet, corn, buckwheat, sunflower, and milo. Plantings of native warm season grasses along road shoulders and selected fields may enhance bobwhite quail habitat. Cool season species include ladino clover, wheat, rye and alfalfa. Planting is normally done by either conventional tillage or the no-till method where the seed is drilled beneath a herbicide killed fescue sod layer. Soil tests are run on the openings prior to planting to determine the appropriate quantities of lime and fertilizer required for plant growth. Soils at MCB typically have a low pH and low natural

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fertility and require the application of lime and fertilizer to promote plant growth.

(2) Planting of selected fields is done on a 3-5 year rotation. Seasonal planting plans will be submitted to the Range Management Branch for review prior to tillage to coordinate habitat management objectives with military training requirements. In year 1, warm season annuals are planted and will remain unharvested in the field through the winter; the field will go fallow until the next fall. This fallow period encourages the growth of highly nutritious forbs to provide foraging habitat and overhead cover during the following summer. In the fall (year 2), the field will be planted to a cool season mixture of cereal grain and legume. Legumes have the unique ability of nitrogen fixation in the soil. This process improves soil fertility by providing nitrogen for the accompanying cereal grain and for future plantings. The perennial legume planting will remain in the field for up to three and one half years at which time the rotation will begin again with a spring annual planting. Fields of suitable size will be divided into sections and planted on different rotations to provide a diversity of types and age of herbaceous vegetation in close proximity to one another.

(3) These plantings are adequate to provide supplemental forage benefits for white-tailed deer when 2-3 percent of a management unit is in distributed openings in a rotational planting plan. A successful planted acre of forage equals 50-100 acres of native forage (Kroll 1995). Only training areas (TA) 14, 15, and 17 have enough cultivated openings to meet the minimum recommendation for deer. An additional 598 acres in the training areas would be needed as follows: TA 5, 56 acres; TA 6, 70; TA 7, 36; TA 8, 5; TA 9, 108; TA 10, 72; TA 11, 108; TA 12, 7; TA 13, 19; and TA 16, 127.

(4) Deer that feed in planted plots forage less on the surrounding woodland browse thus decreasing the impact on the woodland understory (Fulbright and Hehman 1994). A cool season planting normally produces at least ten tons of highly nutritious browse per acre (Koerth and Kroll 1994). Protein contents of native forages normally drop below maintenance levels of 10-12% crude protein content by mid-July (Koerth and Kroll 1994). The planted forage should produce a minimum of 14-17% crude protein. Legumes such as ladino clover provide a high protein forage that is also highly digestible and rich in calcium. Calcium is important for bone and antler formation and influences birth weights. Cereal grains (wheat, rye, barley) provide forage early in the spring and are good sources of phosphorus, important in milk production (Kroll 1995).

d. Erosion Control Plantings. Stream crossings, abandoned tracked vehicle routes, and road rights-of-way are subject to deterioration, erosion, and development of gullies. Stabilization and replanting of disturbed sites is often done as a joint watershed protection/wildlife management project. Replanted areas can provide cover and forage life requisites for wildlife species and provide watershed protection for the aquatic species downstream. Planting mixes of either cool or warm season forage and cover crops are used to

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provide multi-purpose plantings (Figure 6-4). Erosion control plantings often require the application of specialized erosion control materials and engineering practices to control water runoff. Erosion control blankets, straw mulch, hydroseeding, turn-outs, retention ponds and rock weirs have all been successfully used to control runoff and stabilize slopes along road rights-of-way. Along with control of runoff, proper tillage and soil preparation is a key to successful rights-of-way plantings.

e. Agricultural Equipment. The Fish, Wildlife and Agronomy Section operates and maintains farm tractors and a variety of mowers, disc harrows, plows, planters, and spreaders to accomplish vegetation management tasks.

f. Mowing. Managed openings that are not plowed or prescribed burned during a year may be mowed to control the encroachment of woody vegetation and to release previous plantings of ladino clover. Military training operations may require mowing to ensure clear sight lanes. When practical, some strips will be left unmowed in larger fields to produce forage, seed and cover for game and non-game animals. When possible, mowing is delayed until after the primary breeding season for ground nesting birds and mammals. The specific mowing requirement is driven by military training needs. Much of the range mowing is done under the Base Facilities Logistics Support Service (FLSS) contract. Per agreement between the G-3 (Operations Division), FLSS, and NREA Branch, the Fish, Wildlife and Agronomy Section has responsibility for vegetation management on the Landing and Drop Zones listed at Table 6-2. Because mowing promotes grass monocultures, encourages the spread of fescue, and creates a thatch layer, mowing should be minimized and the use of early growing season prescribed burns should be promoted to manage these open areas.

g. Prescribed Burning. Grasslands near range impact areas are the most susceptible areas to wildfire but woodlands throughout the Base are subject to wildfires caused by military incendiary devices. To control the threat of severe wildfires, the Fire Management program, Chapter 5, addresses the firebreak system and prescribed burning program. Primary range areas will be annually burned. Figure 6-3 depicts a fire management area for the corridor from Range 3 in Training Area 7 to the Anti-Armor Tracking Range (R-9) in Training Area 15. The primary intent for wildlife habitat management is to connect frequently burned range areas to create a corridor of continuous grassland habitat for species such as quail that are in decline due to severe habitat fragmentation throughout the region. Except on military training ranges where fire is prescribed on an annual basis, prescribed fire should be applied in alternating strips or blocks every 2 years to maintain grasslands and forest savannahs. Desirable shrubs and cover patches may be protected during burns, either by mechanical disking of firebreaks or by timing the application of fire to coincide with fuel conditions that result in patchy burns. Patchy burns are beneficial in that quail need some patches of unburned grasses to provide nesting sites during the next breeding season. Military training requirements and fire danger ratings take priority in influencing the exact timing of burning.

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When feasible, the majority of burning will be accomplished during the late winter and early spring months just prior to green-up. It is desirable to prescribe burn loblolly pine stands every 3 to 5 years in the Southeast to enhance habitat quality for white-tailed deer and turkey (US Forest Service 1980). Loblolly stands will most likely be burned only on an opportunistic basis in coordination with other forest management objectives. There are too many scattered stands and too few good weather days to accomplish many burn units outside the fire management corridor where burning is essential to support training.

h. Invasive Species Control. Executive Order 13112 directs Federal agencies to use their authorities to prevent the introduction of invasive species, and to control, monitor and restore native species. Some of the most troublesome invasive species in terrestrial habitats at MCB are tall fescue, autumn olive, sericea lespedeza, Chinese silvergrass, tree of heaven, and Japanese knotweed. Inventory and mapping projects are ongoing for these species. Control projects have been undertaken on tall fescue and autumn olive.

(1) Tall fescue

(a) Tall fescue is a non-native dense sod forming grass that is found in many of the managed openings and improved grounds at MCB. For many years, tall fescue was the grass of choice for landowners and farmers. Fescue is a very aggressive grass species that quickly chokes out native grasses and spreads to areas not originally seeded. It forms a dense matted sod that inhibits travel and foraging of quail and other small animals. Compounding the problem, tall fescue often contains the toxic, fungi-produced compounds ergotamine and ergovaline. These compounds have been proven to cause sickness and reproduction problems in ruminants and rabbits.

(b) In 1993, an Environmental Assessment was prepared for the application of herbicide to control tall fescue. The MCB Environmental Impact Review Board approved the use of the herbicide glyphosate (Roundup). In the fall of both 1993 and 1994, approximately twenty acres were treated with glyphosate. Short-term reduction of fescue was noted but within two growing seasons, fescue was again the dominant ground cover. Corn crops planted over fescue sod have appeared to be effective in shading out fescue cover. Repeated combinations of mechanical, chemical and agronomic practices can help reduce the abundance of tall fescue.

(2) Autumn Olive. Autumn olive was once widely used for wildlife and erosion control plantings in the eastern United States. Extensive hedgerows of autumn olive were planted at MCB from the late 1960's - 1984 and readily formed naturalized thickets. It is now considered a pest species, particularly where it has encroached into open training lands. Current management actions at MCB include removing autumn olive by mechanical treatment (bulldozing) to reclaim landing zones and woodland openings that are becoming overgrown.

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(3) Chemical Controls. The use of chemical controls for woody vegetation and invasive plants should be considered. Dominion Power has expressed interest in developing a chemical woody vegetation control program on some utility rights-of-way on Base. Such programs must be coordinated through the Pest Management Program and NEPA review process at MCB.

i. Fruit and Nut Trees. Over 300 old homesites occur at MCB. Many of these have foundation rubble, naturalized daffodils, and remnant orchards of pear, apple and black walnut trees. Pruning, release of competition, and replanting help maintain the old homesite orchards. These homesites provide landscape diversity and are utilized by a variety of wildlife species.

4. Oak Mast Production

a. Acorns provide a significant energy supplement to the diet of many wildlife species in the eastern deciduous forest. Acorn production varies from year to year and populations of many wildlife species are affected by the presence or absence of acorns. An oak mast production survey was initiated in 1973 to serve as an index of acorn production by red/black and white oak species. Results of the survey from 1975 through 2005 are shown at Figure 6-5. Production for both red/black and white oaks was highly variable from year to year. The data reinforce the importance of maintaining a diversity of mast producing species to improve the chances that an adequate supply of food is available in all years. Hickories (*Carya* spp.), black walnut (*Juglans nigra*), American beech (*Fagus grandifolia*), black cherry (*Prunus serotina*), dogwood (*Cornus florida*), and pine seeds become increasingly important when oak mast is deficient. In consideration of damage done to oak trees during the gypsy moth defoliations of 1990-1994, it is especially important to maintain diversified forest stands that contain a variety of oak and other hard and soft mast producing trees.

b. An estimate of the acorn production capability of MCB forests is shown at Figure 6-6. This estimate was compiled by using MCB forest inventory data to compute the number of oak trees per acre and the average diameter of acorn-producing trees by habitat type and by 10-year age classes. Many oak species in this region begin acorn production when they reach ≥ 10 " dbh (diameter breast height) and production increases as the trees continue to grow. Using acorn production tables for white oaks, chestnut oaks, northern red oaks, and southern red oaks in Shaw (1971), a production value in pounds per acre was estimated.

5. Cavity Trees. Cavity trees are important to numerous wildlife species on both upland and riparian sites (Balda 1975, Dickson et al. 1983). Although standing dead trees are generally removed in traditional timber harvest programs, some snags should be left standing unless the snags present a hazard to human life or property.

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6. Riparian Zones

a. Riparian habitats occur throughout MCB in association with streams and tributaries. Riparian habitats are considered to be among the most productive and valuable of all natural systems. These ecosystems play a critical role in maintaining regional biodiversity and are generally characterized by a combination of high species diversity, high population densities, and high productivity. Riparian vegetation also helps control erosion and functions as a buffer to protect streams from the potential impacts of adjacent land uses.

b. Chesapeake Bay Act Riparian Protection Area (RPA) and Streamside Management Zones (SMZ) are established on perennial and intermittent streams as described in Chapter 4. The width of these buffer strips depends on soil type, slope, vegetation, type of human activities, or the presence of sensitive species in the area. In addition to the control of non-point sources of pollution, these zones can be managed to provide large live and dead trees for nesting and escape cavities. Tall trees along the edges of reservoirs, ponds and rivers should be retained to provide nesting habitat for bald eagles and ospreys. Herbaceous vegetation along wetland edges provides shelter for frogs, snakes, turtles, and small mammals. The VDGIF recommends that RPA and SMZ zones, established at 100 feet, are minimal and should be increased to 100 meters where feasible.

6205. HABITAT MANAGEMENT PROJECTS. Table 6-1 provides a summary of the habitat management actions recommended for the land-based wildlife addressed in this chapter. Terrestrial habitat management projects based on these actions are summarized as follows:

a. Forest Habitat Management. Participate in Environmental Assessment process to evaluate management proposals in 3-5 forest compartments annually (about 3,000 acres). Each compartment will be evaluated on a 10-year entry cycle by an interdisciplinary team comprised of but not limited to, the NREA Branch staff in the NEPA, forestry, wildlife biology, and agronomy disciplines. The evaluation will result in ecosystem management prescriptions to integrate forest operations with sustainable wildlife habitat development, threatened and endangered species protection and water quality protection. Habitat management recommendations include:

(1) Intersperse small (average 20 acres) regeneration harvests through areas of mature timber.

(2) Maintain species diversity within forest compartments and retain den and snag trees.

(3) Maintain 50% or more of compartment acreage in timber \geq 40 years of age to promote hard mast production. Monitor oak mast production.

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(4) Manage riparian corridors to protect water quality, provide large snags and den trees, and produce small pockets of short-rotation soft hardwoods (NMHD).

(5) Manage minimum timber harvest rotation age of 100 years in mast-producing hardwood, 70 years in mixed pine-hardwood, and 50 years in pines and non-mast hardwoods. Short rotations (40 year rotation) are recommended in some non-mast hardwoods for woodcock and grouse.

b. Homesites. Maintain and release fruit/nut trees in orchards and homesites. There are about 700 trees under management.

c. Conservation Plantings. Maintain 2% or more of habitat in scattered managed openings. Training areas 5, 6, 7, 8, 9, 10, 11, 12, 13, and 16 have a combined deficiency of 598 acres of cultivated openings. In conjunction with other land management programs such as military range development, erosion control plantings, and logging, additional acres should be returned to a herbaceous cover type to the extent practicable.

d. Prescribed Burning. Use prescribed burning, 1-year rotation on military ranges, 2-year rotation for quail, and 3-5 year rotation for deer and turkey, to enhance grassland and loblolly pine forest habitats. Develop fire management corridors near primary impact/range areas to promote grassland dependent species.

e. Control Invasive Plants. Complete and implement an Invasive Plant Control Plan to restrict the use of non-native plants in landscape plantings; develop a GIS-based weed management information system to make a record of inventory and control actions; establish methodology and logistics for the judicious use of chemical controls; and apply control measures to about 10 acres per year of non-native plants.

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Table 6-1. Summary of recommended terrestrial habitat management actions.		
<u>Species</u>	<u>Management Actions</u>	
	<u>Forestland</u>	<u>Open Land</u>
Wild Turkey	<p>Interspersion of small cutover units (<25 acres) with mature forest units recommended.</p> <p>Maintain mature riparian habitat stringers adjacent to cutovers.</p> <p>Selective harvesting, uneven aged management, recommended for hardwood stands.</p> <p>Release orchards and homesteads.</p> <p>Prescribed burn 1-3 year interval in pines and open fields.</p> <p>Maintain 60% of forest in mast producing stands.</p> <p>Rotations 100 years or greater in hardwood and 50 years or greater in pine.</p>	<p>Exclude mowing late April-late June.</p> <p>Maintain 3% of habitat or 3-8 openings per mi².</p> <p>Brood habitat of grassy openings or young cutover critical.</p>
Quail & Rabbit	<p>Fire-maintained open canopy pine silviculture. Thin basal area to 50ft²/acre.</p> <p>Prescribed burn at 1-3 year rotation. Late spring & growing season burns desirable for hardwood control.</p> <p>Leave slash piles during site preparation.</p>	<p>Develop fire management corridor connecting fields (>10 acres) of warm season and cultivated grasslands. Concentrate in TA's 7, 9, 10A, 14, and 15.</p> <p>Eliminate tall fescue.</p> <p>Use disking or planting rotations to maintain brood habitat of overhead grass that is sparse at ground level. One 1/10 acre plot per 20 acres of quail habitat.</p>

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Table 6-1 (continued). Summary of recommended terrestrial habitat management actions.

<u>Species</u>	<u>Management Actions</u>	
	<u>Forestland</u>	<u>Open Land</u>
Woodcock, Ruffed Grouse	<p>Small scattered clearcuts and log decks for courtship arenas (woodcock).</p> <p>Leave large logs on ground after logging for drumming logs (grouse).</p> <p>40 year timber rotation in soft hardwoods.</p> <p>Small strip clearcuts in riparian zones.</p> <p>Propagate fruit orchards (grouse).</p> <p>Control deer herd to help retain low vine cover.</p>	
Dove		Include warm seasons grains in planting rotations for fields>4 acres.
Gray Squirrel	<p>120-140 year timber rotation.</p> <p>Maintain 40-60% of timber within management compartment in mast producing habitat.</p> <p>Maintain species diversity: dogwood, blackgum, pine, hickory, all are important food sources.</p> <p>Maintain at least 6 den trees per acre.</p> <p>Small selection cuts & uneven aged timber management preferred.</p> <p>Keep clearcuts < 20 acres. Avoid monoculture when regenerating clearcuts.</p>	

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Table 6-1 (continued). Summary of recommended terrestrial habitat management actions.		
<u>Species</u>	<u>Management Actions</u>	
	<u>Forestland</u>	<u>Open Land</u>
White-tailed deer	<p>Scattered timber harvests, each 20 acres or less.</p> <p>Prescribe burn at 3-5 year intervals in pines.</p> <p>Maintain 50% of forest ≥ 40 years of age to enhance hard mast production.</p> <p>Perpetuate oaks.</p>	<p>2% or more of deer management areas cultivated to enhance protein forage production.</p>
Terrestrial Furbearers	<p>Intersperse small irregularly shaped clearcuts through forestland to enhance rodent production.</p> <p>Retain snag and den trees.</p> <p>Maintain diversity of forestland species; promote fruit, soft and hard mast species.</p>	
Songbirds	<p>50% forest reserved from cutting and other 50% cut even-aged on 80 year rotation.</p> <p>Retain at least 8 dead trees (snags) per acre for nest cavities.</p> <p>Leave mature, big trees $> 20"$ dbh in riparian zones.</p> <p>Allow fallen logs to remain on forest floor.</p> <p>Use pesticides judiciously to avoid elimination of food supply for insectivores.</p>	<p>Eliminate tall fescue from semi-improved grounds. Emphasize use of native bunchgrasses and forbs.</p> <p>Develop backyard habitat programs for edge management at schools and public areas.</p>
Pileated Woodpecker, Barred Owl	<p>Maintain > 0.17 snag ($>15"$ dbh) per acre.</p>	

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Table 6-2. Landing and Drop Zones where vegetation management is done by the Fish, Wildlife and Agronomy Section, NREA Branch.

LANDING ZONE NAME (Alternate Name/Location per Appendix C Maps)	TRAINING AREA	ACRES
Albatross (Bunker Agout A&B)	17A	17.4
Bigbird (R-9 Burn Area)	14A	9.8
Bluejay (TA 14B Burn Area)	14B	12.6
Buzzard	15A	24.5
Chickadee (Bishop's A-E)	15A	5.8
Chicken (Confederate Springs)	10A	0.5
Condor (Stung Fields)	10C	6.9
Cuckoo (R-9 Burn Area)	15A	14.1
Dove (Shortleaf Pine 4)	7B	2.2
Eagle (Tops Secret A&B)	16B	1.1
Egret (R-9 Burn Area)	14B	17.0
Falcon (Wysteria)	6B	2.4
Goose	15A	3.0
Goshawk (R-9 Burn Area)	14A	26.0
Hawk (Paulownia)	5B	0.6
Hen (Sawmill)	7B	6.9
Hummingbird (R-9 Burn Area)	15A	3.6
Kiwi (TA 14 Burn Area)	14	3.3
Mallard	11B	2.6
Martin (Hamilton's Trail Fields)	16G	1.6
Parrot (R-9 Burn Area)	14	6.9
Pelican	15A	18.0
Pigeon (Hayfield Farm)	16G	4.7
Quail	11A	1.9
Starling	5A	5.8
Stork (R-9 Burn Area)	15A	51.2
Toucan (Oak)	17A	13.3
Vulture	16A	5.1
Woodpecker	11A	0.8
Wren (Orchard)	11A	1.5
DROP ZONE NAME ¹		
Cockatoo	8A	42.0
Raven	8B	21.0
¹ NREA maintains 1/3 of these areas with annual plantings; the other 2/3 will be mowed by FLSS.		

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Figure 6-2.--Habitat Resources (clockwise from upper left): managed openings, landing zones, forests, grasslands and developed areas.

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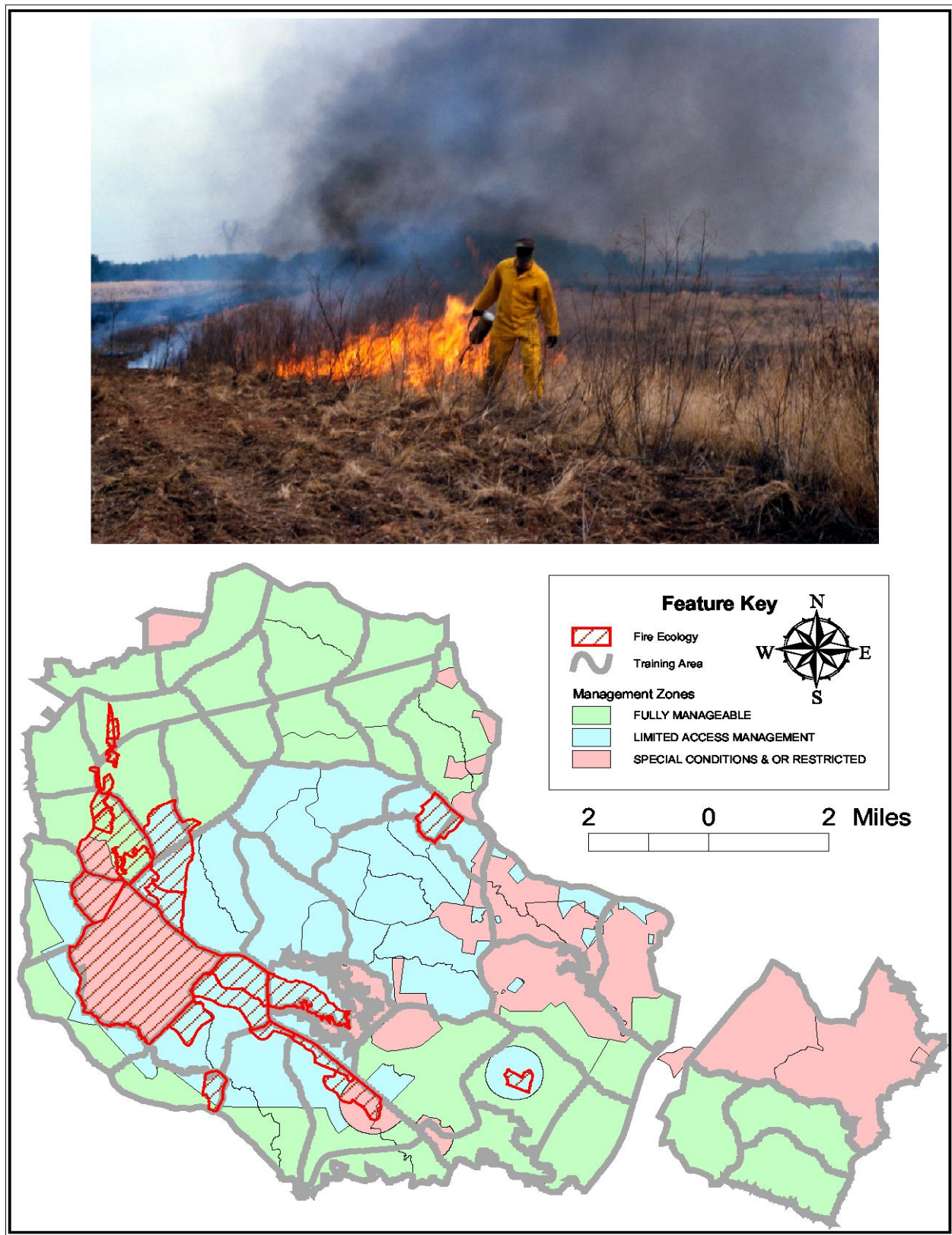


Figure 6-3.--Land management zones and fire management area.

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a. Soil preparation.
matting.



b. Erosion control



c. Completed conservation planting in
South Fork, Quantico Creek, watershed



d. Route 644 soil erosion.
project.



e. Completed reclamation

Figure 6-4.--Erosion Control Plantings.

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Figure 6-5.--Acorn Production Index at Marine Corps Base, Quantico.

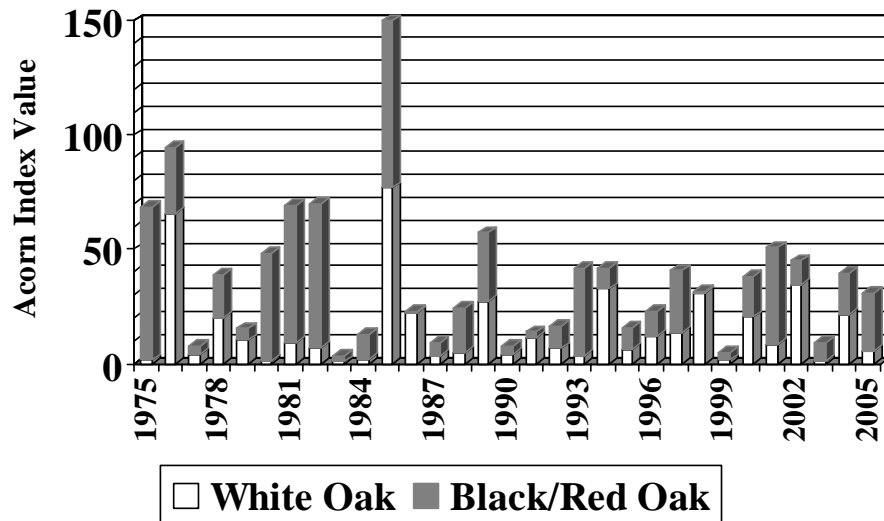
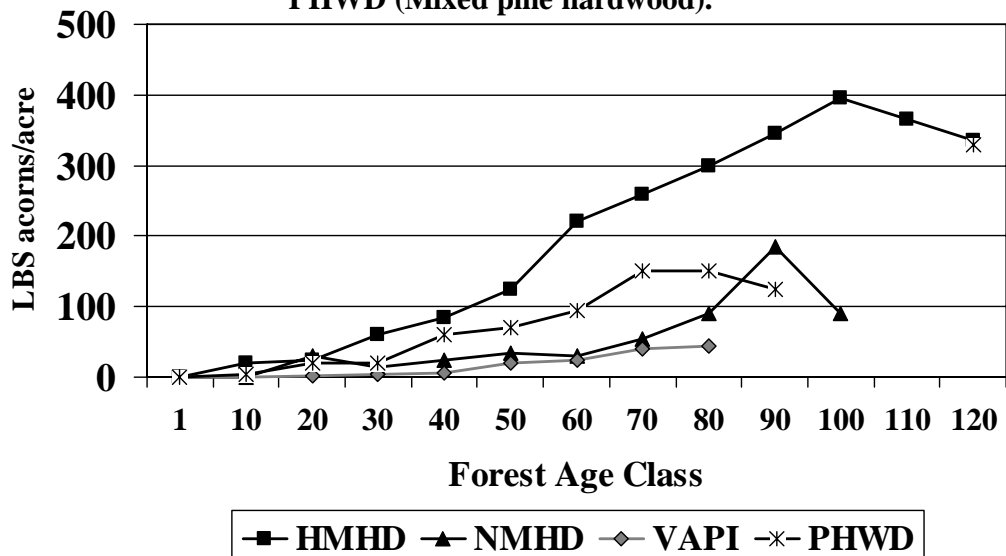


Figure 6-6.--Acorn production potential for Quantico forest habitat: HMHD (Hard mast-producing hardwood); NMHD (non-mast producing hardwood); VAPI (Virginia pine); PHWD (Mixed pine hardwood).



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CHAPTER 6

FISH AND WILDLIFE RESOURCES

SECTION 3: WATERFOWL/WETLAND HABITAT MANAGEMENT

6300. INTRODUCTION

1. Waterfowl are highly prized by the American public for hunting, wildlife viewing, and their natural beauty. A cooperative plan to manage waterfowl resources at Marine Corps Base, Quantico, was completed in September 1989 by the U.S. Fish and Wildlife Service (USFWS) and MCB (USFWS and MCCDC 1990). Guidance for developing this plan was derived from the "Joint Agreement of Cooperation to Perpetuate North American Waterfowl Populations". Under this agreement the USFWS and the Department of Defense pledged participation in a joint venture to implement the North American Waterfowl Management Plan (NAWMP) on military lands for the benefit of waterfowl and other associated wetland species.

2. The primary objective of waterfowl management at MCB is to support the NAWMP by increasing and/or enhancing the availability of wetland habitat needed to support both brood rearing and wintering habitat for waterfowl. The wood duck (*A. sponsa*), mallard (*Anas platyrhynchos*) and black duck (*A. rubripes*) are three important species cited in the NAWMP that are year-round residents at MCB. The Canada goose (*Branta canadensis*) and tundra swan (*Cygnus columbianus*) are other species found at MCB that are highly visible due to their size and use of habitat frequented by humans. Table 6-3 provides a listing of the waterfowl species that have been observed at MCB.

3. The Virginia Department of Game and Inland Fisheries (DGIF) is a participant in the NAWMP and in Atlantic flyway waterfowl management. All MCB waterfowl management programs and activities are coordinated with the appropriate VDGIF biologists.

4. Avian Influenza Surveillance Plan. In accordance with a nationwide strategy to monitor for the arrival of the HPAI H5N1 influenza virus in the United States, in 2006 the DGIF developed a plan to collect 800 samples from target waterfowl species in Virginia. Two of these species, mallards and tundra swans, are found at Quantico and are taken by local hunters. The Quantico Game Check Station has been identified as a potential location for the collection of samples. On an as-needed basis, MCB biologists will provide support to the DGIF for collecting samples in the Quantico area.

6301. WETLAND HABITAT RESOURCES AT MCB. MCB wetlands identified in the National Wetlands Inventory conducted by the USFWS consist of approximately 3,905 acres of palustrine, riverine, and lacustrine wetlands and are described in Chapter 2. These habitats, particularly

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the riverine, lacustrine, and palustrine open water (PFO), emergent (PEM) and scrub/shrub (PSS) habitats are the most often used by waterfowl for feeding, loafing and nesting habitats. The most important wetlands for waterfowl are found in the lower Chopawamsic Creek drainage where a complex of over 400 acres of open water, tidal emergent, and intertidal emergent wetlands attract hundreds of migratory and resident birds. Plants of these wetlands are listed at Table 6-4.

Table 6-3. Waterfowl Species Reported for MCB, Quantico, Virginia.

Tundra swan (*Cygnus columbianus*)
Mute swan (*C. olor*)
Canada goose (*Branta canadensis*)
Wood duck (*Aix sponsa*)
Mallard (*Anas platyrhynchos*)
American black duck (*A. rubripes*)
Green-winged teal (*A. crecca*)
Blue-winged teal (*A. discors*)
American wigeon (*A. americana*)
Northern pintail (*A. acuta*)
Ring-necked duck (*Aythya collaris*)
Greater scaup (*A. marila*)
Lesser scaup (*A. affinis*)
Ruddy duck (*Oxyura jamaicensis*)
Common goldeneye (*Bucephala clangula*)
Bufflehead (*B. albeola*)
Hooded merganser (*Lophodytes cucullatus*)
Red-breasted merganser (*Mergus serrator*)
Common merganser (*Mergus merganser*)
Redhead (*Aythya Americana*)
Gadwall (*A. strepera*)
Canvasback (*Aythya valisineria*)
Shoveler (*Spatula clypeata*)
American coot (*Fulica americana*)
Common loon (*Gavia immer*)
Horned grebe (*Colymbus auritus*)
Pied-billed grebe (*Podilymbus podiceps*)

6302. WATERFOWL SPECIES OCCURRENCE AND HABITAT REQUIREMENTS

1. Wood Duck

a. The wood duck is a common breeding resident of MCB. From late February through April, the wood duck is commonly seen singly or in small groups throughout palustrine emergent and open water habitats. After broods hatch in May and new vegetation becomes thick, wood ducks are rarely seen until late summer. Then, a wood duck roost forms in the Chopawamsic Creek tidal area and is estimated to contain upwards

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Table 6-4. Plant species noted for Chopawamsic Creek and Quantico Creek (VDCR 1992).

Scientific Name	Common Name	Chopawamsic Creek	Quantico Creek
<u>RIVERINE AQUATIC BEDS</u>			
<i>Cabomba caroliniana</i>	Carolina fanwort	X	
<i>Ceratophyllum demersum</i>	Common hornwort	X	X
<i>Heteranthera dubia</i>	Water star-grass		X
<i>Hydrilla verticillata</i>	Hydrilla	X	X
<i>Myriophyllum spicatum</i>	Eurasian water-milfoil	X	X
<i>Potamogeton foliosus</i>	Leafy pondweed	X	
<i>Sparganium americanum</i>	American bureed	X	
<i>Spirodela polyrhiza</i>	Greater duckweed	X	X
<i>Vallisneria americana</i>	Wild celery	X	X
<u>PALUSTRINE EMERGENT WETLANDS</u>			
<i>Acer rubrum</i>	Red maple	X	X
<i>Acorus calamus</i>	Sweetflag	X	X
<i>Alnus serrulata</i>	Smooth alder	X	
<i>Amaranthus cannabinus</i>	Tidmarsh amaranth	X	
<i>Amorpha fruticosa</i>	Indigobush	X	X
<i>Asclepias incarnata</i>	Swamp milkweed	X	X
<i>Bidens coronata</i>	Tickseed sunflower		X
<i>Cephalanthus occidentalis</i>	Buttonbush		X
<i>Cinna arundinaceae</i>	Wood reedgrass		X
<i>Clematis terniflora</i>	Japanese virgin's bower		X
<i>Commelina virginica</i>	Virginia dayflower		X
<i>Conoclinium coelestinum</i>	Mistflower		X
<i>Decodon verticillatus</i>	Water willow	X	X
<i>Eleocharis quadrangulata</i>	Square-stem spikerush	X	X
<i>Helenium autumnale</i>	Common sneezeweed		X
<i>Hibiscus laevis</i>	Halberd-leaf rosemallow		X
<i>Hibiscus moscheutos</i>	Swamp rosemallow	X	X
<i>Justicia americana</i>	Water willow		X
<i>Lobelia cardinalis</i>	Cardinal flower	X	X
<i>Ludwigia palustris</i>	Water purslane		X
<i>Mikania scandens</i>	Climbing hempweed		X
<i>Murdannia keiskei</i>	Marsh dewflower	X	X
<i>Nelumbo lutea</i>	American lotus	X	X
<i>Nuphar leuteum</i>	Spatterdock	X	X
<i>Panicum virgatum</i>	switchgrass	X	X
<i>Peltandra virginica</i>	Arrow arum	X	X
<i>Phragmites australis</i>	Common reed	X	
<i>Polygonum arifolium</i>	Halberd-leaf tearthumb	X	X
<i>Polygonum hydropiperoides</i>	Mild water pepper		X
<i>Pontedaria cordata</i>	Pickernelweed	X	X
<i>Rosa palustris</i>	Swamp rose	X	
<i>Rumex verticillatus</i>	Swamp dock		X
<i>Sagittaria latifolia</i>	Common arrowhead		X
<i>Scirpus validus</i>	Soft-stem bulrush	X	X

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<i>Scirpus americanus</i>	American three-square	X	X
<i>Spartina cynosuroides</i>	Big cordgrass	X	X
<i>Typha angustifolia</i>	Narrow-leaf cattail	X	X
<i>Vernonia noveboracensis</i>	New York ironweed	X	X
<i>Zizania aquatica</i>	Wild rice	X	

of 500 birds. Wood ducks migrate and become scarce during the colder winter months of December and January, but begin to return in February to establish breeding territories. Beaver ponds and the flooded woodlands of the lower Chopawamsic Creek wetlands are the best areas to observe wood ducks at Quantico.

b. Wood ducks nest in tree cavities. While suitable nest sites have limited breeding populations in many geographic areas, the mature timber at MCB provides numerous natural cavities suitable for wood duck nesting. Wood duck nests at MCB are most likely to occur in palustrine forested wetlands along riparian corridors. These corridors generally have a non-mast hardwoods (NMHD) cover type classification as described in Chapter 2. As part of MCB forest compartment examinations made in 1990 and 1991, data were collected at each sample plot to indicate the presence of cavities suitable for wood duck nesting. The data indicated that most MCB NMHD timber stands greater than 41 years of age have adequate nesting cavities for wood ducks.

c. Wood duck brood-rearing habitat consists of areas that have an interspersed of open water with abundant invertebrate foods and hiding cover. Palustrine emergent and shrub/scrub wetlands comprise the best wood duck brood habitat at MCB. Isolated beaver ponds have relatively little satisfactory brood habitat and do not appear to be important production areas at MCB.

2. Mallard

a. Mallards typically nest in upland vegetation near water or along the periphery of marshes, lakes, ponds, and sloughs. Mallards will frequently nest on suitable islands, where they may occur in dense concentrations. Mallard nests have been found at many MCB beaver ponds and reservoirs but little data has been collected to indicate the success of these nesting attempts.

b. Predators are known to destroy a number of mallard nests, hens, and ducklings annually, and nest predation can have a major impact on annual production (Johnson and Sargeant 1977, Sargeant and Arnold 1984). Extensive predator control has proven successful in artificially increasing duck production on small sites but is not cost-effective in large areas. On MCB reservoirs, the wildlife manager has observed duck broods being attacked by fish and/or turtles. Ensuring a diversity of wetland habitats and adjacent herbaceous nesting cover will help reduce predation at most sites.

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c. In the winter, mallards are rarely found at beaver ponds but can be found in large numbers in the wetlands of lower Chopawamsic Creek. During October, November and December, mallards may number in the hundreds in the lower Chopawamsic Creek and Potomac River wetlands where hydrilla has become abundant. During prolonged freezing spells, mallards are driven out of Chopawamsic Creek by the ice but may remain in the Potomac River near the outfalls of power plants and sewage treatment plants where the water does not freeze as fast.

3. Black Duck

a. The black duck breeds in forested habitats more often than other dabblers, but estuaries, tidal marshes, freshwater streams, inland lakes and reservoirs, and small woodland pools are also used (Wright 1954, Kirby 1988). Beaver pond complexes provide excellent nesting and brood-rearing habitats (Renouf 1972, Whitman 1987) in the northeast. Despite the abundance of beaver pond complexes at MCB, no black duck nests have been found at MCB in recent years. However, the presence of black ducks in late summer flocks at MCB suggests that the black duck is a year-round breeding resident.

b. Black ducks winter primarily in marine and estuarine wetlands on the East Coast (Bellrose 1980). Secondary wintering habitats include a diversity of habitats including marshes, lakes, impoundments, beaver ponds, rivers, and flooded forests. At MCB, black ducks are frequently observed in small flocks in the lower Chopawamsic Creek wetlands. Black ducks are occasionally seen at Lunga Reservoir. The black duck is considered a Tier II species (very high conservation need) in the Virginia Wildlife Action Plan.

4. Canada Goose

a. Both migratory and resident Canada geese can be found at MCB. A resident flock of giant Canada geese was established at MCB in 1987 with the release of 42 wing-clipped geese at Lunga Reservoir; since then the birds have successfully nested in most wetland habitats aboard the base. A wide variety of nest sites have been used, including mats of vegetation, beaver lodges, shorelines, and artificial nesting platforms.

b. Brood-rearing habitat is primarily shallow emergent marshes with nearby meadows or pastures (Bellrose 1980). Hatchling geese feed primarily on vegetation and select the nutritious young growth part of emergent plants (Sedinger and Raveling 1984). Brood-rearing habitat must be fairly close to the nest site to minimize gosling mortality. Geese have been very successful in rearing broods at Lunga Reservoir, where the presence of grass fields in recreation areas has provided excellent foraging habitat for the young geese.

5. Tundra Swan. At MCB, tundra swans are a common resident in lower Chopawamsic Creek throughout the winter as long as ice does not form.

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While swans often number less than 100, numbers often peak during February and up to 1,000 swans can be observed from the Chopawamsic Creek Wildlife Viewing Area. They arrive about the first of November and leave in early March.

6303. CENSUS TECHNIQUES

1. Wintering Waterfowl. For a 10-year period beginning in 1992, a weekly waterfowl survey was conducted at MCB from late September through March. Waterfowl numbers were recorded from observation sites at Lunga Reservoir, Chopawamsic Creek, and the Potomac River. The census results, shown in figures 6-7 and 6-8, provide information about the relative abundance of waterfowl during the migratory period but greatly underestimate total numbers of waterfowl. During the fall migration peak, up to 10,000 waterfowl have been seen at one time on Chopawamsic Creek.

2. Roost Counts. Roost flight counts have been historically used as an index to yearly wood duck population trends (Hester and Quay 1961). The roost count technique may provide a suitable index at the local level. At MCB, a wood duck roost forms in the lower Chopawamsic Creek tidal area in late summer. Roost counts at sunset may be a useful tool at MCB to monitor local numbers of wood ducks.

3. Banding/harvest Surveys. Useful information for management can be obtained from banding programs, harvest surveys, and wing-collection surveys. Population estimation techniques are based on the size and rate of the harvest as determined from these surveys. These surveys are organized and managed on a regional basis by the USFWS and state conservation agencies. MCB is a willing participant and provides assistance to the USFWS and VDGIF to band waterfowl on MCB property.

6304. MANAGEMENT PRACTICES. The emphasis of waterfowl management is to maintain existing wetland resources (no-net loss wetlands) and ensure the availability of a diversity of interconnected wetland complexes throughout the installation.

1. Riparian Corridors. Forested streamside zones provide particularly valuable waterfowl habitats that require special protection from development. These habitats are designated as Riparian Protection Zones (RPA's) under the Chesapeake Bay Agreement. Corridors or buffer zones adjacent to wooded wetlands provide essential travel lanes needed for young wood ducks to successfully reach brood-rearing habitats. To maintain vegetation on riparian protection zones is valuable for water quality, waterfowl management, and is required under the Chesapeake Bay Agreement.

2. Greentree Reservoirs

a. Greentree reservoirs (GTRs) are impounded tracts of bottomland forests that are flooded during the dormant season to attract

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waterfowl. To avoid tree damage in GTRs, fall flooding should begin no earlier than the first leaf color changes that signal the onset of dormancy (Fredrickson and Batema 1992). Flooding should occur slowly, and flooding depth should be no more than 7 inches (18 cm) over as much of the area as possible to optimize the amount of food available for foraging ducks. Timber management within a GTR and the surrounding area should ensure a diversity of mast-producing and cavity trees. With the continued loss of natural forested habitat in the South, GTRs have often been constructed to provide a dependable source of food, cover, and water.

b. Because of the rolling terrain at MCB, there are few floodplain sites that have the flat terrain suited for GTR management. The Cedar Run floodplain in Training Areas 17A and 17B was identified in the MCB Waterfowl/Wetlands Management Plan as a potential GTR site. This site would require some dikes or berms to contain water and might also require pumping of water from either wells or from Cedar Run to provide a source of water for flooding.

3. Shallow Impoundments

a. Shallow impoundments can be constructed and managed to provide an abundance of desirable waterfowl foods and open water for resting and brood rearing. Managing shallow impoundments to promote the growth of submerged aquatic vegetation requires maintaining permanent water levels during the growing season at depths of 4 to 10 in. (10 to 25 cm). During drought, water levels may be maintained by pumping. If necessary, they are drawn down during the growing season every 1 to 3 years to allow the reestablishment of emergent plants.

b. Six sites were identified in the MCB Waterfowl/Wetlands Management Plan for the development of shallow impoundments. Following engineering surveys, design, and environmental assessment, only two sites were feasible. Shallow impoundments were constructed on those sites in 1998.

4. Prescribed Burning. Hindman and Stotts (1989) stated that except for water-level manipulation, prescribed burning is the most effective waterfowl habitat management practice used in the Chesapeake Bay region. Burning helps maintain desirable annuals, discourages undesirable herbaceous perennials and herbaceous species, removes matted vegetation, releases nutrients, and increases seed availability in dense vegetation. Much of the prescribed burning has been done in the more saline marshes of the eastern shore. However, there may be potential to use prescribed burning in some of the marshes of the Chopawamsic Creek tidal area.

5. Agricultural Crops. Uplands in the region have become increasingly valuable for a number of waterfowl species. Canada geese and tundra swans use fields of winter wheat, barley, and rye extensively throughout the Maryland-Virginia-North Carolina region (Hindman and Stotts 1989). Wheat, rye and barley are sometimes cultivated as winter crops in the landing zones at MCB. However, these fields,

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which only average several acres in size, are not generally large enough to attract flocks of waterfowl. Canada geese use smaller fields in Training Areas 10B/C located adjacent to Lunga Reservoir, but for the most part, fly off base to large agricultural operations.

6. Wood Duck Nest Boxes. Nest boxes are a useful management tool when used in areas where the lack of suitable nest sites has been identified as being responsible for limiting increases in breeding wood duck populations (Bellrose 1990, Wilkins et al. 1990). A well monitored wood duck nest box program was operated at MCB from 1990 - 1995 but had little success in increasing wood duck production.

7. Goose Nest Structures. A variety of artificial nest structures, including wash tubs, cones, and floating platforms, which in effect simulate small islands, can be used to stimulate the productivity of resident geese.

8. Submerged Aquatic Vegetation (SAV). SAV's are among the more important waterfowl foods in the Chesapeake Bay region and are responsible for attracting good numbers of ducks and geese to the Quantico area. The Virginia Natural Heritage Division, while searching Chopawamsic and Quantico Creeks in 1991-1992 for rare species, recorded the aquatic vegetation they encountered (Table 6-3). A number of valuable waterfowl food species were recorded. Ecosystem management initiatives are ongoing in the Chesapeake Bay region to increase the abundance of SAV's. There is currently no quantitative measure of SAV's in MCB waters, although most waters less than 8 feet deep have dense mats of SAV by August each summer.

9. Invasive Species. The common reed, *Phragmites communis*, is displacing preferred marsh vegetation in many wetlands of the mid-Atlantic region and has been targeted as a nuisance species. It is found in small patches both east and west of Interstate 95 at MCB. Experimental efforts to eradicate *Phragmites* at Lunga have been successful using spraying with formulations of glyphosate herbicide formulated for aquatic applications.

6305. MCB WATERFOWL MANAGEMENT HISTORY

1. Plantings. During the 1970's, efforts were made to control water levels in beaver ponds and plant waterfowl foods (browntop millet and Japanese millet) in the pond margins after the water level had been drawn down. In 1987, Japanese millet was sown around the shoreline of Lunga Reservoir to germinate during the normal summer draw-down. Also in 1987, tubers of wild celery were planted in the Chopawamsic Creek tidal marsh in an attempt to introduce submerged aquatic vegetation to that marsh. In 1988, a wildlife opening, "Halfmoon Field," on the northwestern shoreline of Lunga Reservoir, was expanded from 3 to 9 acres to provide grassland foraging habitat for waterfowl, deer and turkeys.

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2. Wood Duck Nest Boxes. In 1990, 106 plastic wood duck nesting boxes were installed and monitored at MCB. These were provided through a cooperative effort between Ducks Unlimited and the VDGIF. The boxes were mounted on galvanized poles and were placed over shallow water in beaver ponds and along creeks. No successful nests were recorded in these boxes from 1990 through 1992. In February 1993, 50 of these boxes were replaced by wooden boxes equipped with tunnel-type predator guards. Also, many boxes were moved to new locations. Wood duck nest boxes were not used in 1993 although several broods of wood ducks were observed during the nest box monitoring program.

3. Goose management. The development of a resident goose flock at MCB was in progress by 1986 but was augmented by the release of wing-clipped Canada geese at Lunga Reservoir in the summer of 1987. This flock was often accompanied by 100 to 125 wild geese from late fall 1987 to mid-March 1988. Nest structures were installed to enhance nesting success, but were curtailed about 1996 to help prevent the further growth of a resident flock. Adverse impacts from droppings in recreation areas and around administrative buildings grew to an outcry by 2000. Consultations with the USDA Animal Damage Control led to the issuance of a USFWS Depredation Permit to MCB for the taking of unwanted geese near airfields and the addling of eggs to reduce reproductive success. The permit was conditional on also using non-lethal methods such as harassment to deter geese from lingering in undesirable places. Since 2001, herding dogs have been used to harass geese and drive them away from administrative areas.

4. Hunting. Waterfowl harvest data for MCB from 1962 through 2005 are displayed at Figure 6-9. An average of fewer than 100 ducks were harvested annually from 1972 through 1989. During that period, the Base managed four hunting blinds in Chopawamsic Creek. In 1990, the harvest began to increase due to an increase in numbers of wintering waterfowl brought about by the resurgence of SAV's in the Potomac River. Also, the Base added additional hunting blinds, bringing the total to 20 public hunting blinds east and west of I-95.

5. Surveys and Banding. MCB has assisted the VDGIF in the capture and banding of Canada geese, wood ducks and other waterfowl in Chopawamsic Creek and at Lunga Reservoir.

6. Mute Swans Surveys. In 1990 and 1993, MCB assisted the VDGIF in an Atlantic flyway survey for mute swans. Since that period, mute swans have been occasionally spotted as transients but are not known to have successfully nested in the Quantico area. The mute swan is a non-native species believed to have negative impacts upon wetland systems and native wildlife.

6306. MANAGEMENT RECOMMENDATIONS. The following management programs are supportive of waterfowl management.

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1. No-Net Loss of Wetlands. Compliance with the Department of Navy policy to accomplish no-net loss of wetlands is probably the most important objective of the MCB waterfowl management program. The Natural Resources and Environmental Affairs Branch must maintain records of wetlands gains and losses and ensure that mitigation is accomplished for wetland losses.

2. Beaver Management. Because beaver flowages are recognized as high quality habitat, the beaver population at MCB should be maintained as high as possible without undue timber or other economic losses. The judicious use of a control program to maintain the population at a desirable level should be continued. In some instances, beaver drains may be inserted into culverts to allow partial draw-downs to prevent road flooding. Expenses include traps, special culvert materials, and heavy equipment support to unclog culverts.

3. Wood Duck Nest Box Program. Nest box programs are very popular with the public and are an ideal means to recruit volunteer and youth participation in natural resources management programs. However, it is questionable whether nesting cavities are limiting to wood ducks at MCB. Nevertheless, the wood duck nest box program may be continued with cautious enthusiasm as a means to involve the public in wildlife service projects. Even if wood ducks do not use the boxes, the boxes are often found by gray squirrels, screech owls, and other wildlife.

4. Resident Goose and Mute Swan Management. It is advised that the resident Canada goose population continue to be carefully monitored and controlled using both lethal and non-lethal methods. Any nests of mute swans detected in the Quantico area should be destroyed.

5. Impoundments

a. Shallow Ponds. Two shallow ponds, South Branch Pond (2 acres) and Coops Gobbler Road Pond (5 acres) were constructed in support of the NWMP and require annual maintenance of the spillways and dam.

b. Moist Soil Management. Opportunities for moist soil management of preferred waterfowl foods should be considered at the 8 ponds and lakes at MCB. The normal hydrologic cycle results in summer drawdowns of these reservoirs. During the drawdown, the growth of desirable waterfowl foods along the shorelines may be encouraged by appropriate plantings.

6. Waterfowl Surveys.

a. Wintering waterfowl surveys should be made once per week from mid-September to mid-March by ground survey.

b. Manpower and logistic support should be provided to the DGIF to capture and band resident waterfowl at MCB.

7. Hunting Blinds. The maximum number of hunting blinds, within safety considerations, should be licensed per Virginia regulations and

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be made available for public access use during scheduled hunting seasons.

8. SAV'S. An inventory of SAV should be conducted in Quantico impounded and tidal wetlands to determine the extent and distribution of SAV species.

9. Invasive Plants. The location and area covered by Phragmites reed should be inventoried and mapped, and a control plan should be implemented.

10. Avian Influenza Surveillance. At the request of the DGIF, tracheal and cloacal swabs from hunter-harvested tundra swans and mallards will be collected in support of the Atlantic Flyway Council surveillance plan for avian influenza.

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Figure 6-7. Waterfowl Observations West of I-95

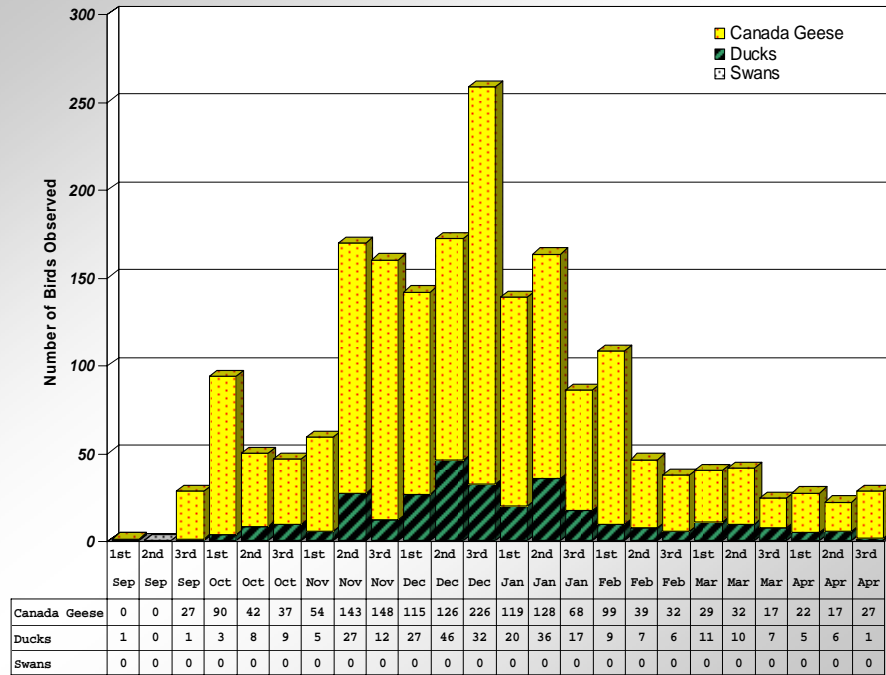


Figure 6-8. Waterfowl Observations East of I-95

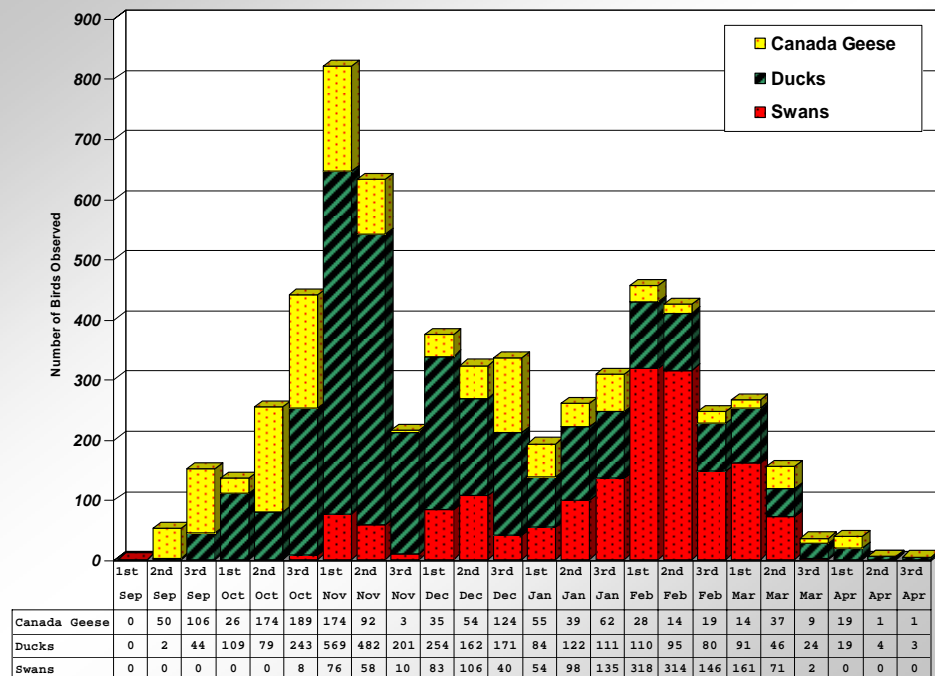
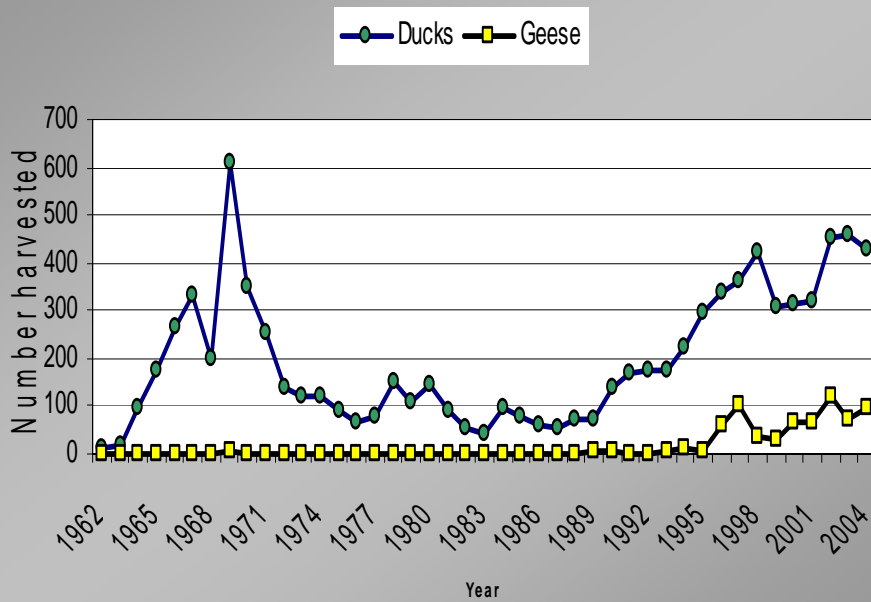


Figure 6-9. Waterfowl Harvest Records for MCB Quantico



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CHAPTER 6

FISH AND WILDLIFE RESOURCES

SECTION 4: WILD TURKEY

6400. MANAGEMENT GOALS AND OBJECTIVES. Management of the wild turkey (*Meleagris gallopavo*) supports the INRMP drivers to provide outdoor recreation and sustain native species. The wild turkey is an important game bird and its widespread distribution throughout the installation provides significant recreational opportunities during both fall and spring hunting seasons. The public takes great interest in the well-being of this species. This Section goes into some detail about forest management relative to wild turkey abundance because the public can become emotionally charged concerning perceived effects of timber management on turkey populations. Management objectives are to (1) manage vegetative communities in a manner that maintains or improves existing wild turkey habitat, and (2) implement census procedures to monitor the turkey population.

6401. GENERAL ECOLOGY AND LIFE HISTORY. The annual life cycle of wild turkeys can be divided into three seasons: breeding season, nesting and brood-rearing season, and a fall-winter season.

1. Breeding. In Virginia, Bailey and Rinell (1976a) reported that breeding generally begins in late March, and mating peaks about mid-April. A second peak of gobbling activity occurs about 2-4 weeks later when most hens have been serviced and are no longer attracted to males.

2. Nesting and Brooding. Nesting takes place immediately after hens are fertilized. Most of the hens at MCB will be incubating during April and the first half of May. Peak hatch dates typically occur from mid-May through mid-June when spring vegetation green-up is well advanced and food and cover are plentiful. Females that lose a nest early during the breeding season may nest again though hens that lose broods are very unlikely to attempt to reneest. Late hatches of turkeys at MCB have been reported during the last week in July. After hatching, poults remain with their mothers until at least September, at which time the majority of poults have completed their post-juvenile molt. During the brood-rearing season, turkey flocks generally consist of 1 or 2 hens with their respective broods. Unmated hens occasionally join brood flocks, or alternatively, form flocks composed entirely of barren hens. During the summer months, poults spend the greater portion of each day foraging.

3. Fall-Winter. Early season flocks consist almost entirely of hens and juveniles, although mature males occasionally interact with these flocks. In years of high poult production, juvenile males (jakes) leave their natal flocks by mid-November and form flocks composed

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entirely of jakes. Segregation by age-class is often very pronounced within the male cohort of the population during winter. Not only do jakes form discrete flocks, but 2-year-old, 3-year-old, and very mature gobblers form their own flocks as well. Flocking behavior begins to wane with the approach of the breeding season, and older gobblers eventually leave flocks to establish breeding territories in March. However, jakes and hens may maintain loose flock affiliation throughout the breeding season. Generally these flocks disintegrate entirely during April when nesting and incubation are at their annual peaks.

6402. HABITAT RESOURCES AT MCB. The only areas at MCB that do not provide habitat for wild turkeys are the open water wetlands and developed areas. Over 52,000 acres of forestland and about 2,900 acres of open land are available to wild turkeys for habitat. Mast producing hardwood forests (HMHD) and mixed pine/oak forests (PHWD) comprise 73% of MCB forestland, riparian areas of non-mast producing hardwoods (NMHD) comprise 5%, and pine stands (CONI) comprise 22%. Turkeys utilize all of these cover types to obtain year-round requirements for shelter and food. Herbaceous cover types important for turkeys include burned grasslands and cultivated woodland openings.

6403. HABITAT REQUIREMENTS. Wild turkeys are very adaptable and can tolerate a variety of habitat types and conditions. Upland hardwood forests (HMHD) are primary habitat types (Ross and Wunz 1990, Sisson et al. 1990), although birds also make use of cropland (Porter 1976, Kurzejeski and Lewis 1990), pastures (Speake et al. 1976), pine plantations (Smith et al. 1990), conifer groves (Ross and Wunz 1990), and riparian habitat (Burk et al 1990). Ideal turkey habitat is typified by the interspersed of these vegetation types (Schaffer and Gwynn 1967).

1. Woody Vegetation. Trees and shrubs are important producers of hard and soft mast and also provide cover for turkeys. Large, mature trees provide horizontal cover, while understory trees, shrubs, and vines are significant from a structural perspective due to the screening cover furnished at ground-level. The presence of large trees is considered an essential habitat feature for roosting turkeys (Shaffer and Gwynn 1967). Species such as, blueberry, blackberry, wild grape (Korschgen 1967), and serviceberry (Luckett 1980) are of dual value because they provide turkeys with both summer food and low screening cover.

2. Grass Cover. Herbaceous communities function as brooding and to a lesser extent nesting cover. Hens often nest in grassy openings as long as grass stem densities are low enough so as not to impair the escape behavior of incubating hens. Broods spend a significant amount of time in pastures or forest openings. Grasses are also of indirect importance in that the plants provide habitat for insects which are

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important food items throughout the year and critical to the survival of young poults.

3. Forb Cover. Like grasses, forbs are integral components of brood-rearing cover. Broods often favor tall perennial forb communities because poult mobility is generally unrestricted within the understory, yet the canopy formed by the interlacing network of aerial leaves and stems furnishes excellent horizontal cover. Hayden (1961) reported that ferns furnished very young broods with secure hiding and loafing cover. Poults are also attracted to mixed forb-grass communities due to the diversity of insects that utilize forbs as sources of food and cover (Wunz 1990).

4. Bare Ground. Although wild turkeys frequently obtain food directly from a plant by stripping grass seedheads or pulling fruit from the stems of shrubs and vines (Korschgen 1967), the birds also locate significant amounts of food on the soil surface. Insects, hard mast, and small forbs are much easier to locate on soil surfaces that are free of litter. Bare ground also furnishes turkeys with dusting sites (Bailey and Rinell 1967b) and facilitates movement through ground vegetation.

6404. MANAGEMENT PRACTICES. Habitat management and harvest management are two of the most important aspects of wild turkey management. A vegetation cover type database maintained in the MCB Geographic Information System and updated regularly will provide current information on habitat conditions. An annual census should be used to document any significant changes in turkey numbers that would warrant the restriction or increase in hunting opportunities, or would require population restoration efforts.

1. Habitat Management: General. Although mature upland forest is the single most important habitat type associated with wild turkey populations in the Southeast, maintaining extensive, undisturbed tracts of forest is not a fundamental requirement of wild turkey management. Productive turkey populations frequently occupy landscapes that are composed of various combinations of woodland, cropland, fallow field, idle area, and pasture habitats; thus, adequate interspersions of these major land-use types is the key to successful wild turkey management.

2. Timber Management. Since forests are crucial wild turkey habitats and timber production is an important land use practice at MCB, silvicultural practices may have greater effect on turkey habitat than any other land use program at MCB. The forest management practices listed in Chapter 5 and Chapter 6, Section 2, are intended to support turkey management as long as the harvesting techniques and schedules are carefully planned and implemented. Turkey populations can be maintained in managed hardwood forests (Wunz 1990), commercial pine plantations (Burk et al. 1990) or combinations of both (Holbrook et

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al. 1987) so long as the bird's food, cover, and water requirements are sustained on the area throughout the year.

a. Even-aged Management. Bailey and Rinell (1967b) noted that even-aged, sustained yield management can be beneficial to wild turkey populations as long as cutting is limited to small stands, stand age classes are balanced, stands of the same age class are evenly dispersed, and woody species diversity is maintained. Clearcuts and shelterwood silvicultural systems are common harvesting methods employed in the Southeast and at MCB.

(1) Clearcuts. Many researchers consider small, evenly distributed clearcuts a better habitat management alternative than large clearcuts. Luckett (1980) recommended limiting the size of clearcuts to less than 40 acres if wild turkey production was an important management consideration. Donohoe (1990) maintained that wild turkey populations derive considerable benefit from a harvesting regime that results in an even distribution of clearcuts characterized by a size limitation of 25 acres.

(2) Shelterwood Cuts. In mature oak-hickory forests where the production of these species is inadequate, shelterwood systems can be used to favor the establishment of oak (Society of American Foresters 1981). Shelterwood systems promote oak seedling growth because the shade provided by the few mature trees left unharvested lower soil temperatures to a level that encourages acorn germination and oak seedling development (Society of American Foresters 1981). Since peak acorn production occurs at three to four year intervals, turkeys must rely on other mast-producing species when acorns are scarce. Therefore, shelterwood cuts should not exceed 20 to 30 acres in size and be distributed throughout the forest among stands of other mast-producing species.

(3) Harvest Rotations

(a) Studies conducted in eastern hardwood forests indicate that mid- to long harvest rotations produce habitat conditions most conducive to wild turkey management. Wunz (1990) stated that 100-year harvest rotations should be scheduled for Pennsylvania hardwood forests in which wild turkey production is an important management objective. Chapter 5 of this Plan recommends 100-year rotations for HMHD management at MCB.

(b) Wild turkeys appear to tolerate shorter harvest rotations in pine plantations. Smith et al. (1990) noted that turkeys made significant use of short-rotation pine plantations in Mississippi. Gehrken (1975) reported that a harvestable turkey population was maintained on a South Carolina forest that was dominated by even-aged pine plantations. However, a network of hardwood travel corridors connecting plantations with mature hardwood stands were retained on both of these study areas and were thought to be the primary reason wild turkeys remained in these intensively

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managed forests. The 50-year rotations for pine management recommended in this INRMP should support wild turkeys.

(4) Thinning. Thinning of loblolly pine stands as recommended in Chapter 5 should enhance pine habitat for turkeys. Smith et al. (1990) found that one commercial thinning operation made pine plantations in Mississippi more attractive to turkeys. Complete removal of every fourth row created travel lanes and opened the canopy sufficiently to increase the abundance of herbaceous foods and soft-mast producing vines

b. Uneven-aged Management. Selective harvesting can be utilized to improve habitat interspersation within a forest to the benefit of the resident wild turkey population. In addition, Lockett (1980) observed that round-wood and firewood thinning reduced competition within a stand and stimulated mast production among remaining trees. Similarly, Bailey and Rinnel (1967b) stated that modest pulp-cutting and saw-wood removal operations enhance turkey habitat quality by promoting crown development and stimulating seed production. Beech and oaks are valuable mast-producing trees that should be retained during thinning operations. If the harvest of desirable species is unavoidable, emphasis should be placed on improving stands by removing diseased and/or deformed trees.

3. Management of Openings

a. The management of openings at MCB is described in Section 2 of this Chapter. Recent clearcuts, cultivated fields, old homesites, old fields maintained by fire, military landing zones, and right-of-ways all support life requisites of turkey populations. Opinions vary as to what percentage of turkey habitat should be devoted to openings. Various researchers have recommended anywhere from 3-50% of turkey habitat should be maintained in managed openings. As noted in Section 2, managed openings are less than 1% of the MCB landscape; if there is any habitat deficiency, it would be the shortage of permanent openings.

b. Mowing. Mowing is used to deter invasion by woody plant species into open fields. Mowing also helps release desirable clover from overhead grasses and forbs. Because herbaceous lands are important nesting and brood-rearing sites, these areas should be avoided when possible from April through June, as mowing may cause nest abandonment and/or high brood mortality.

4. Prescribed Burning

a. Prescribed burning is beneficial tool for turkey habitat management. Burns conducted at 1 to 3 year intervals helps maintain the park-like or open nature of pine woodlands by curtailing shrub invasion. In addition to maintaining open understory conditions within pine forests, prescribed burning also stimulates herbaceous seed and soft-mast production. Felix et al. (1986) noted that the

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intensity of burning affected the quality and quantity of forage production in young pine plantations in Virginia and therefore influenced wild turkey use of plantations.

b. Fire prevents heavy accumulations of ground litter and decadent standing plant material, thus enhancing turkey foraging activity. Young poults can also move more easily through regularly burned herbaceous vegetation, which helps them evade predators. Ideally, a discontinuous burn is desirable; this produces a patchwork of unburned nesting cover and poult escape cover intermingled with burned patches comprised of abundant food.

5. Artificial Feeding. Providing turkeys with feeders or scattering free grain is of questionable value and has not been practiced at MCB. Artificial food delivery programs are considered unnecessary and undesirable.

6. Harvest Management. Dense turkey populations can endure high hunting pressure over an indefinite period of time as long as sufficient quantities of good habitat remain available. The current Virginia regulations, which allow the harvest of 3 turkeys per year per person at MCB, do not appear to have had an adverse effect on the MCB turkey population. Annual fluctuations in the MCB turkey harvest seem to be related to nesting success and the availability of fall food. Recent Virginia studies indicate that turkeys are less vulnerable to shooting when there is a large acorn crop. A shortage of acorns causes the birds to concentrate around planted areas where they are more vulnerable to shooting. The same studies found that predation accounts for nearly half of the adult turkey mortality and that legal hunting and poaching evenly split the other half. In 1995, the VDGIF adopted a shortening of the fall turkey-hunting season in an attempt to increase hen survival, productivity and the overall population size.

7. Population Surveys. Severe weather conditions or disease outbreak have the potential to drastically reduce turkey populations. To detect any major population changes, it is essential that the turkey population be censused annually. Spring gobbler counts are a popular method used throughout the Southeast to monitor population trends over an extended period of time and/or to compare gobbler abundance between different management areas. Recent research from Pennsylvania indicated that brood counts were reliable indices of population abundance on both a regional and statewide basis (Wunz and Ross 1990).

6405. MCB HISTORICAL DATA

1. Gobbler Counts. MCB wildlife personnel have conducted spring gobbler counts annually since 1970. Gobbler counts have fluctuated around an average of 82, ranging from a high of 139 gobblers heard in 2001 to a low of 22 recorded in 1988 (Figure 6-10).

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2. Harvest Data

a. Since 1970, annual spring gobbler harvests have fluctuated around an average of 42 birds, ranging from a low of 21 in 1970 to a high of 80 gobblers in 1998. The annual harvest variation observed over the past 30 years is not uncharacteristic of healthy turkey populations. The harvest trend is similar to the gobbler count trend (Figure 6-10), providing credence to the belief that major changes in turkey population size may be detected by the spring gobbler count. Both harvest and count results are subject to weather variations that may influence the activity patterns of wild turkeys, observers and hunters. Harvest results can be affected by military training schedules and the availability of hunting areas.

b. Fall turkey harvests are shown in Figure 6-11. Results vary widely depending upon nesting success and the availability of acorns. A combination of high nesting success and poor mast production at MCB in 1979 and 1987 resulted in a record fall turkey harvests those years. Mediocre to poor nesting success since 1998, shortening of the Virginia fall turkey season, and fewer fall turkey hunters have resulted in low fall harvests since 2000.

3. Brood Production. Records are maintained of all turkey broods observed by natural resources employees during their daily summer work assignments. Numbers of flocks and total numbers of juvenile turkeys observed are recorded. Since 1970, the best count years were 1993 when 73 flocks and 445 juvenile birds were counted and 1996 when 100 flocks and 575 juvenile birds were counted (Figure 6-11). The worst count year on record was 1999 when only 11 flocks and 32 juveniles were observed. Annual productivity appears to vary widely based upon weather conditions during the hatching peak in late May.

4. Food Habit Study. Information regarding wild turkey food habits on MCB was obtained via examination of 30 crops collected between 1983 and 1987. Invertebrates were the most frequent food item consumed, occurring in 21 of 30 crops (Table 6-5). A variety of hard and soft mast-producing species were important. Beech nuts, dogwood fruit, acorns, grapes, and partridge berries also appeared to be important food items based on both their frequency of occurrence and quantity. Grass seeds, as well as forb and grass leaves, were found in about 33% of the crops.

5. Wild Turkey Weights. Turkey weights are obtained for both sexes as well as for adult and juvenile age classes from birds brought to the check station. Average weights of adult males harvested during the fall ranged from 15 - 16 pounds and juvenile male weights fluctuated around 11 pounds. Hens harvested during the fall averaged from 8.5 to 9.9 pounds while average juvenile hen weights were 8 pounds. Average spring gobbler weights ranged from 17 to 19.5 pounds.

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Table 6-5. Crop contents of 30 wild turkeys harvested during the fall, 1983-1987, at MCB.

Food Item	Quantity (g)	Number of Crops
Beech nuts	273	8
Acorns	125	9
Dogwood berries	281	12
Autumn olive	557	2
Honeysuckle berries	51	4
Holly berries	81	2
Black Gum berries	11	1
Grapes	174	6
Partridgeberry	132	12
Poison Ivy	78	8
Beech drops	137	4
Spring Beauty tubers	90	2
Mushrooms	122	6
Grass seeds	72	9
Grass leaves	54	7
Shrub and Forb leaves	70	8
Invertebrates	115	21

6406. MANAGEMENT RECOMMENDATIONS

1. Habitat Management. Each timber sale or other land management activity is evaluated under the National Environmental Policy Act (NEPA) procedures. The MCB, Fish, Wildlife and Agronomy Section should evaluate each action affecting turkey habitat to determine opportunities to mitigate damages or expand opportunities for improvement of habitat as described in this chapter. Basic habitat recommendations are:

- a. Use selective harvesting uneven-aged management for hardwood stands.
- b. Harvest rotations of 50-60 years in pines and 100-120 years in hardwoods are recommended.
- c. Maintain mature riparian habitat stringers adjacent to cutover forest.
- d. Distribute small pine clearcuts (20 acres average size) through-out a forest compartment to accentuate habitat diversity
- e. Conduct patchy prescribed burns, implemented at 1 to 3 year intervals.

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f. Thinning operations should be conducted in even-aged timber stands to promote wide spacing of trees which allows for more plant diversity in the ground cover and understory.

g. Maintain scattered small openings through the woodlands to be managed by burning, mowing, release and cultivation practices. A density of 8 openings/mi² is recommended.

h. Exclude mowing from late April-late June when feasible.

2. Population Surveys

a. Gobbler Survey. Annual spring gobbler counts should be made to provide a spring index of turkey abundance.

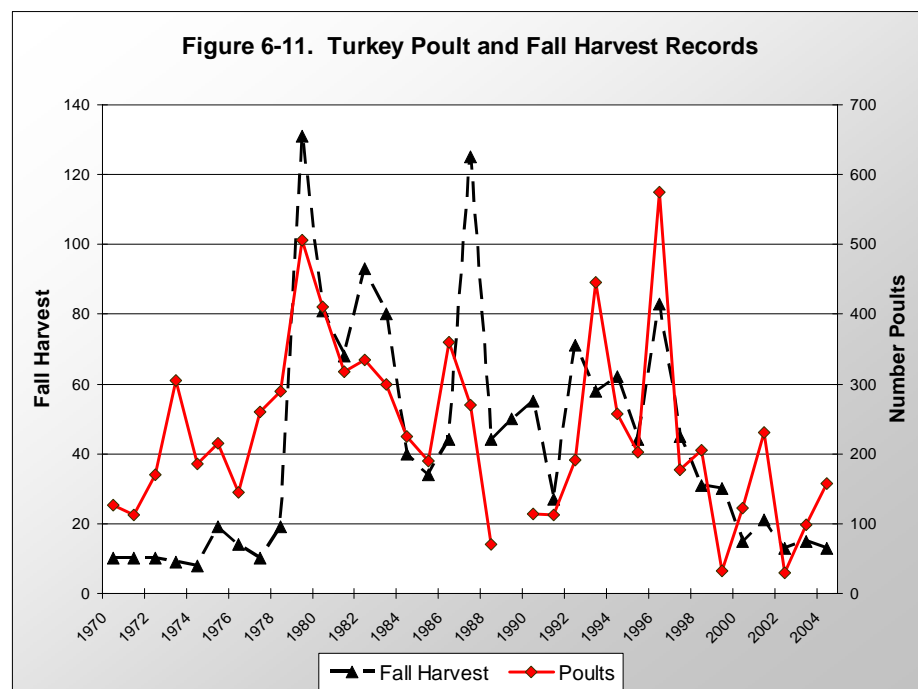
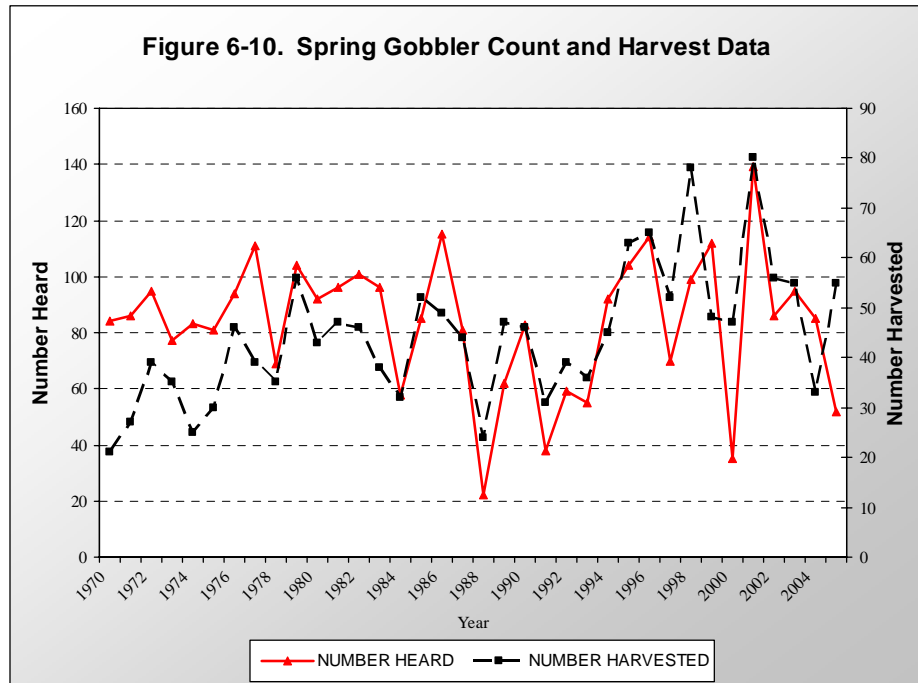
b. Brood Counts. Summer hen-brood counts provide a useful productivity index and should be continued.

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Figure 6.11 (1).--Spring gobbler hunting is a popular outdoor recreation activity at MCB, Quantico.

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CHAPTER 6

FISH AND WILDLIFE RESOURCES

SECTION 5: WHITE-TAILED DEER

6500. MANAGEMENT GOALS AND OBJECTIVES. The white-tailed deer is abundant in all training areas at Quantico. As the primary game species in Virginia, deer are highly treasured for the hunting opportunities they provide. Many citizens take pleasure in opportunities to observe white-tailed deer in natural habitats. However, deer are adaptable to a wide range of habitat conditions and are becoming more numerous in urban environments. Large numbers of deer consume enough vegetative material to potentially impact other plant and small animal communities. Some scientists suggest that deer browsing may affect understory plant abundance and related habitat for migratory birds. Deer consumption of acorns can reduce the availability of this important energy supply for other animals. Deer serve as hosts for tick species that are responsible for the transmission of Lyme disease to humans; high deer densities have been related to high tick densities. Some citizens are concerned about deer vehicle collisions on busy roads and the damage deer inflict on gardens and flowerbeds. Other citizens are becoming increasingly vocal to protect deer from hunting activities. It is evident that society has many different values concerning the management of deer. Deer management objectives are to sustain a quality deer hunting program, keep the deer population density within the tolerance limits of Base residents and staff, and to keep the deer herd in balance with other land use and resource management objectives.

6501. LIFE HISTORY. Detailed information about white-tailed deer life history is available in a number of references, including Halls (1984) and the previous versions of this INRMP. One of the most important events, breeding, appears to peak about the third week in November at MCB based on fetal measurements. Adult females produce an average of 1.56 fawns, based on data collected from MCB road-kills.

6502. HABITAT REQUIREMENTS. White-tailed deer are adapted to a wide range of habitat conditions. In general, habitat quality for white-tailed deer may be affected by the following factors: availability of food and water, nature and extent of cover, interspersions of food and cover, and inherent soil fertility.

1. Food and Water Resources

a. Food. A primary habitat requirement is the availability of nutritious forage that will satisfy the seasonal energy requirements of white-tailed deer. Whitetails are foraging generalists and readily consume many types of vegetation. Short (1986) developed a white-

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tailed deer Habitat Suitability Index (HSI) model intended for use in the South Atlantic coastal plain. The model used the quantity and quality of forages and available metabolizable energy in autumn-winter to predict habitat quality for deer. Banker and Stauffer (1994) evaluated this HSI model at MCB and identified eight classes of forage on Base considered suitable for deer (at least 41% digestibility):

- (1) Current year's twig growth and needles from pines.
- (2) Current year's fallen leaves from perennial woody species.
- (3) Leafy browse composed of evergreen or tardily deciduous leaves in situ on perennial woody species.
- (4) Mast from all vegetative layers including acorns, fleshy fruits, and seeds from many agricultural crops.
- (5) Leguminous seeds.
- (6) Cool season grasses and forbs (succulent) including growing herbaceous agricultural crops.
- (7) Mushrooms.
- (8) Ground pine (*Lycopodium clavatum*) and running pine (*L. digitatum*).

Based on white-tailed deer energy requirements, Banker and Stauffer (1994) found that the HSI value in all MCB habitats was the maximum value (1.0) assuming that the energy in all of the available forage material could be utilized. They have suggested modifying the model by assigning the following utilization rates (percent of available forage expected to be consumed by deer) related to the quality of forage: current year twigs and needles, 5%; dried, fallen leaves, 0.5%; leafy browse, 20%; mast, 50%; cool season grasses and forbs, 20%; mushrooms, 50%. The most nutritious forages at MCB, leafy browse, mast, grasses/forbs, and mushrooms, are generally less abundant than the poor quality forages of twigs, needles and fallen dried leaves. By assigning utilization rates, a range of HSI values less than 1.0 can be calculated for MCB deer management units. Banker and Stauffer (1994) have suggested that the abundance of high quality forage rather than the total quantity of forage may be the better indicator of habitat suitability within a deer management unit.

b. Water. Man-made reservoirs, beaver ponds, perennial streams, and springs provide a year-round supply of water within deer home ranges at MCB. Therefore, water is not a limiting resource.

2. Cover

a. The type and amount of cover required by white-tailed deer depend to a great extent upon regional conditions, particularly

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weather and predation. In the northern parts of deer range, conifer stands provide essential thermal cover during severe winter weather. Winter cover is less critical for deer in more southern latitudes. In the Quantico area, snow is intermittent or almost entirely absent; hardwood brush, mountain laurel thickets, and young pine stands are readily available to provide protective cover.

b. Dense escape cover may help deer survive the hunting season. Other than hunting pressure, predation is believed to have little impact on MCB deer populations. Coyotes and foxes occasionally take deer but it is believed that their predation is limited primarily to diseased or crippled animals. Coyotes have become established at MCB and fawns may be important in the summer diet of territorial pairs.

3. Habitat Interspersion. Deer populations appear to thrive in areas of high habitat diversity (McCaffery and Creed 1969). Any given habitat type usually provides optimal food resources during only one or two seasons; therefore, the interspersion of habitat types throughout a home range affords a wider range of year-round food and cover resources than do large uniform habitats. Important habitat types include mature forests (40 + years of age), early successional forests (15 years of age or younger), open grassland areas, wetlands, and agricultural lands. With the juxtaposition of several habitat types, deer also receive benefits from the intervening ecotones. Deer tend to use diurnal habitats that offer adequate cover and nocturnal habitats that have the best foraging areas.

4. Soil Fertility

a. Inherent soil fertility affects the nutrient quality of plant materials eaten by deer and is ultimately reflected in the physiology of the animals. Mineral deficiencies in forages grown on soils of low fertility may affect population characteristics such as density, productivity, average weights, and antler development. In a practice known as geophagy, deer ingest soil material to take in salts and minerals. Deer will visit both artificial and natural "licks" to consume these dietary supplements. This practice occurs mainly in the spring and summer.

b. MCB soils are generally acidic and infertile. The best agricultural soils at MCB are generally the Triassic soils found in the northwest training areas of the Base. Banker and Stauffer (1994) found that average buck weights from areas of Triassic soils (training areas 14, 15 and 17) were larger (but not statistically significant) than weights from the other deer management areas on Base.

6503. DEER HABITAT RESOURCES AT MCB

1. The area west of Interstate 95, known as Guadalcanal, has been managed for deer hunting since at least 1962. The Guadalcanal area is further subdivided into deer management units based on training area

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boundaries. The management units east of Interstate 95 are Mainside, north of Chopawamsic Creek, and Officer Candidate School (OCS), south of Chopawamsic Creek. Mainside is the only area with a significant amount of development, supporting most of the administrative buildings and all of the housing facilities on the Base. Despite the development, there are still large undeveloped tracts of woodlands.

2. All vegetated habitats, including forests, rights-of-way, utility corridors, golf courses, lawns, and forested wetlands, provide food and shelter for white-tailed deer. Virginia biologists have used a 40-10-20 "rule-of-thumb" for predicting the winter capability of forest vegetation types to support white-tailed deer populations. In general, forests 15 years old or younger (seedling-sapling) can support 40 deer per square mile through the winter. Forests 16-39 years of age (pole-timber) can support only 10 deer per square mile, and forests 40 years of age and older (sawtimber) can support 20 deer per square mile. These figures are estimates for herds that are maintained in good condition. Herds may survive at higher densities but may consume so much of the vegetative growth that the quality of the range is damaged. At high densities, forages of the highest nutritional quality may become scarce. As range quality deteriorates it is believed that herd characteristics such as average weight, antler growth, and reproductive rate will decline. In years of high acorn production, hard mast producing forests (HDWD) and mixed pine-hardwood (PHWD) forests over 40 years old are capable of supporting greater numbers of deer because of the increased amount of nutritional energy in acorns that is available to the deer. Grasslands, especially when mowed and fertilized, can produce large quantities of highly nutritious forage. Lawns, golf courses, parade fields, landing zones, and managed openings may produce enough energy to support 80 or more deer per square mile.

3. In a deer habitat study of MCB woodlands, Banker and Stauffer (1994), measured the relationship between metabolizable energy and forest age. Their study was done in a year of mast failure and therefore did not include acorns in the analysis. Their results suggest that younger forests provide about 4 times the energy of pole-timber stands (16-39 years old), and twice the energy of stands over 40 years of age. In years of acorn mast production, the energy value in HDWD and PHWD habitats would increase greatly in both quality and quantity in stands over 40 years of age. This result lends some credence to the ratio of 40-10-20 being used to describe the relative deer carrying capacity (in deer/mile²) of seedling-sapling, pole-timber, and sawtimber forest stands.

4. The habitat resources available at MCB are summarized at Table 6-6. Based on the available acreages, estimated winter carrying capacities for the three primary deer management areas are: Guadalcanal, 23 deer/mile²; Mainside, 36 deer/mile²; and OCS, 24 deer/mile². These estimates were based on the assignment of carrying capacity estimates based on the 40-10-20 rule of thumb for forested habitats. Forested wetlands and old field habitats were assigned a

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Table 6-6. Acres of deer habitat at Marine Corps Base, Quantico, and estimate of the winter carrying capacity (WCC).								
HABITAT TYPE	MAINSIDE		OCS		GUADALCANAL		TOTAL	
	Acres	WCC: # deer	Acres	WCC: # deer	Acres	WCC: # deer	Acres	WCC: # deer
Forest <= 15 years of age	0	0	125	7.8	5,123	320	5,248	328
Forest 16-39 years of age	9	0.1	88	1.3	3,840	60	3937	62
Forest >= 40 years of age	2,551	80	2455	77	37,412	1,169	42,418	1,325
Old Fields: broomsedge grass, seedling/sapling	36	2.3	99	6	3,504	219	3,606	225
Cultivated/mowed grassland	954	119	104	13	964	121	2,022	253
Forested wetlands	75	5	31	2	38	2	144	9
TOTAL	3,625	206	2902	107	50,881	1,891	57,375	2,202
SQUARE MILES: DEER/MILE ²	5.66	36.4	4.53	23.6	80.77	23.4	89.65	24.6

value of 40 deer/mile², and managed grasslands were assigned a habitat value of 80 deer/mile². It is emphasized that these values are estimates and that they may vary considerably based on acorn production, weather, and annual variations in land management practices.

6504. **MANAGEMENT PRACTICES.** Habitat management, deer population estimation, and harvest management are primary deer management practices. Any land use actions that affect vegetation composition and structure will affect deer habitat quality. Habitat management consists of practices of forestland and openland vegetation management that enhance food quality for deer. Population management primarily involves the monitoring of herd numbers and/or physical condition to evaluate requirements for population control or opportunities for population expansion. Both habitat and population management are important for maintaining a herd in balance with the ecosystem.

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1. Habitat Management. Almost all terrestrial habitats that are vegetated within 5 feet of ground level will support white-tailed deer. Quality habitats are believed to be those that provide adequate year-round amounts of nutritious forage and adequate cover within an average home range area (one square mile). The vegetation types that contribute most to quality deer habitat appear to be young forests (<15 years of age), mature forests (>40 years of age), old fields, managed grasslands, and vegetated wetlands. The vegetation type that contributes the least to deer habitat appears to be pole size forests, 16-39 years of age. Chapter 6, Section 2 covers management practices for forest stands, managed openings, and fire maintained ecosystems.

2. Deer Population Estimation. Both direct and indirect census methods are available for estimating deer density. Direct techniques involve counting actual animals and using the data to estimate the total population; examples are spotlight counts, aerial surveys, and drive counts. Indirect techniques rely upon counting sign and converting the data to an index that is relative to the total number of animals in a particular population; track counts and pellet group counts are indirect methods. Each census method has inherent shortcomings and constraints. Census techniques are seldom used as independent methods for estimating density but are best utilized in conjunction with one or more other techniques. The results obtained are not actual animal numbers present on a management area but are estimates of deer numbers that can be used to monitor trends in population density.

a. Spotlight Counts. The spotlight count is a direct census technique used to inventory species such as deer that have a tendency to "freeze" when blinded by high power spotlights. Spotlight counts are a reliable, cost effective method used to census deer on relatively large tracts of land with minimum manpower and equipment expenditures. These counts are most reliably conducted in open range habitats. Because Quantico is mostly forested, spotlight counts are limited in applicability. They cannot be used at all while deciduous trees are leafed out; however, after leaf fall, there is some visibility into hardwood stands and the technique may be used.

b. Track Counts

(1) Track counts are usually conducted in late summer when adult deer populations are more stable. Where it is not feasible to prepare road surfaces for a summer track count, counts are sometimes conducted after snowfall in the winter. However, counts taken during this time of year are likely to underestimate the actual deer density of an area, especially if they are conducted after the harvest season.

(2) Improved roads and forest trails of known lengths are used as permanent transects and are sampled annually. About 24 hours after the completion of snowfall, 2-member sampling crews drive all transects and count the number of deer tracks observed on the transects. Density is estimated by using simple equations that relate

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the total number of tracks counted to the total number of miles censused and the average daily home range diameter (Tyson 1959).

c. Pellet Group Counts

(1) Pellet group counts have been developed and used extensively to census white-tailed deer populations in northern forests (Mooty 1980, Creed et al. 1984) and on western ranges. The technique is best suited for arid regions where preservation of pellet groups is optimal. Transects are established throughout the census area, and data is collected from plots along the transects. To calculate density from these counts, the defecation rate (number of pellet groups per deer per day) must be known for deer of the region in which the census area is located. Formulae have been developed to calculate density from these data by using the plot size, acreage of the census area, and average number of pellet groups per transect (Eberhardt and Van Etten 1956, Mooty 1980).

(2) Pellet group counts are subject to much error and bias and should not be used as independent estimates of density. Regional differences in defecation rates and difficulty locating pellet groups in the woods render estimates obtained from this technique questionable. Use of pellet group counts in the Southeast has been unsuccessful because of the rapid decomposition and disappearance of pellets in the warm, humid climate (Downing et al. 1965, Overton 1971).

d. Harvest Data. Measurements of deer sex-age composition of the harvest taken from deer at game checking stations can be useful for reconstructing population structure (Creed et al. 1984). Average weights of deer, antler beam diameter of yearling bucks, and overall condition are useful indicators of range condition and the presence of disease conditions.

3. Harvest Management. Information from census data and habitat evaluation must be integrated to determine a deer population size compatible with deer range resources. Human social factors may also exert an important influence on management decisions, such as the demand by the public to reduce deer/vehicle collisions, observe deer, or preferences of hunters to bag trophy bucks. Major harvest strategies include:

a. Buck-only Harvest. Restricting hunting seasons to bucks only is the surest way to minimize the harvest (McCullough 1984). Buck-only hunting results in the following: (a) high residual population of predominantly females; (b) low recruitment rates; and (c) legal bucks comprising 10% or less of the population (McCullough 1984).

b. Maximum Sustainable Yield. This strategy, sometimes referred to as either-sex hunting, produces the greatest number of bucks (McCullough 1984). To obtain the maximum yield of bucks over time, both sexes and all ages of deer must be harvested. This results in a

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population where the buck and doe components are more nearly equal and recruitment is greater.

c. Quality Deer Management. Quality Deer Management (QDM) is the process of delaying harvest on young bucks combined with an aggressive doe harvest. The goals of this management practice are to achieve a 1:1 buck/doe ratio and to maintain a healthy deer herd that is in balance with its habitat. By not harvesting younger bucks the age structure of the buck population increases and older bucks generally have larger body weights and antler size. The female segment of the population must be harvested to control overall population size and growth rates. A goal of this type of herd management is to produce and maintain a more natural density and social balance in the deer herd, where birth and death rates of male and female deer are nearly equal.

6505. HISTORICAL DATA

1. Spotlight Counts. Winter spotlight counts were begun in 1992 to initiate population surveys for deer in the Mainside deer management unit east of Interstate 95. Increasing complaints about the number of vehicle/deer collisions at Mainside made it necessary to begin a more active deer management program. Concurrent counts were also made at Guadalcanal deer management areas to provide comparable data. Counts from night surveys can be highly variable, but the results shown at Figures 6-12 and 6-13 suggest that there are more deer per square mile east of I-95 than west of I-95. This trend is supported by harvest data, which documents that Mainside archers bag up to three times more deer per square mile than their counterparts west of I-95.

2. Track Counts. Since 1977, post-hunting season deer track counts have been conducted within about 24 hours after snowfall. Proper conditions for a track count only occur sporadically for the following reasons: snowfall events of an appropriate depth are rare (heavy snows result in impassable roads; light snows melt too rapidly to provide a good track count); the day following snowfall must be relatively free from military live-firing activities in order to permit access to training area roads; and personnel and 4-wheel drive vehicles must be available at short notice. Due to conflicts with training activities the same track count transects can rarely be surveyed from year to year. Nevertheless, 17 useable track count surveys west of I-95 have been conducted at Quantico and the results are shown in Table 6-12. It should be kept in mind that these estimates are not based on repetitive surveys and that weather conditions following storms could vary greatly and affect deer movements. Also, troop movements within training areas may increase deer movements and may bias survey results on some transects. Nevertheless, night surveys and deer track counts produce reasonably similar population trends for west of I-95.

3. Pellet Group Counts. Results are available from one large-scale pellet group count survey conducted at MCB. North Carolina State

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University Department of Statistics, working for the Virginia Department of Game and Inland Fisheries, analyzed data collected along 200 100-meter pellet count transects. From these data, the fall 1972 deer herd density was estimated at about 70 deer per square mile.

4. Harvest Data. Deer harvest data have been collected at MCB since 1962. A graph of total harvest is provided in Figure 6-14. Collection of additional harvest data (weight and antler points) was begun in 1965 to assess herd health and range conditions based on yearling buck weights, the percent of yearlings with branched antlers, and to allow computation of population densities using the sex-age-kill method. Yearling antler beam diameter (YABD) is a good indicator of the range condition and productivity of deer herd (Severinghaus and Moen 1983) and has been measured since 1984.

a. Yearling Antler Beam Diameter

(1) Average weights were determined for MCB yearling bucks grouped into YABD size classes. The average weights of MCB deer increase as YABD increases (MCB 1997). Moen et al. (1986) proposed that average YABD greater than 20mm indicates excellent range conditions and that YABD less than 15.5 indicates poor range condition. Using this categorization method for MCB, average yearling buck weights less than 79 pounds would indicate poor range conditions and average weights greater than 85 would indicate excellent range conditions

(2) The average YABD for MCB deer correlates well with the MCB acorn production index from the previous year (MCB 1997). This documents that range conditions for MCB deer improve when there is a good acorn crop. Fawns that have an abundant food supply of acorns may survive the winter at a heavier weight than fawns existing on a browse diet. They may also grow larger antlers the next spring due to their improved nutritional condition. Because the improved nutrition also affects the female segment of the population, Severinghaus and Moen (1983) have used YABD as an independent variable to predict the reproductive rates of female deer giving birth the following spring.

b. Range Condition/Weight of Yearling Bucks. Average hog-dressed weights of MCB yearling bucks from 1965-2005 are shown at Figure 6-15. Also shown are lines predicting range condition based on YABD. From 1965 through 1968, yearling bucks averaged 90-96 pounds, indicating excellent range conditions. From 1969 to 1979, average yearling buck weights never declined below an 80 pound average. During the 26 years from 1980 to 2005, average yearling bucks weights exceeded 80 pounds on only 2 occasions, suggesting declining range conditions.

5. Hunting

a. Since 1966, an either-sex (maximum sustained yield) shotgun hunting program in the Guadalcanal area has resulted in sustained

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annual harvests comprised of about 55% bucks and 45% does (Figure 6-16). Antlerless deer (either-sex) hunting has been legal during special archery season (4-5 weeks) and for 10 or more days during the firearms season. A special muzzleloading rifle season scheduled in Virginia during early November has not been allowed at Quantico. About 14-15 days of either-sex firearms hunting appears necessary to achieve a 50:50 buck:doe harvest.

b. The percent of yearling bucks among adult deer (1½ years and older) has shown a decline since the early 1980's (Figure 6-17). This has resulted in greater buck survival and an increased harvest of bucks in 3½, 4½, and 5½ year age classes. The decreased harvest of younger bucks may be due to public support and practice of QDM along with delaying the firearms harvest until late November.

c. Deer hunting was not conducted in the Mainside and OCS management areas east of Interstate 95 until the late 1980's. The OCS area was opened to archery hunting in 1987 and firearms hunting in 1990. In response to concerns about deer/vehicle collisions in the Mainside area, a limited archery program was initiated there in 1992. The Mainside area was also enrolled in the Virginia Deer Management Assistance Program (DMAP) so that participating hunters could harvest up to two antlerless deer per day that would not count against their daily or season bag limits.

6. Lyme Disease

a. During the past two decades, Lyme disease has become the most commonly diagnosed arthropod-borne illness in North America. The causative agent is a bacterial spirochete (*Borrelia burgdorferi*) transmitted by the deer tick (*Ixodes scapularis*). Deer are not good spirochete reservoirs and play no role in the natural enzootic maintenance of *B. Burgdorferi* transmission, which involves larval and nymphal ticks that feed on small mammals, principally white-footed mice (*Peromyscus leucopus*). However, deer are the single most important vertebrate host for feeding by adult ticks, thereby strongly influencing the tick's reproduction, abundance and distribution. A positive relationship has been documented between the number of immature ticks and the density of deer. Therefore, regulation of deer numbers may become important from the standpoint of disease risk reduction.

b. In 1991, the U.S. Army Environmental Hygiene Activity, Fort Meade, Maryland, conducted a Lyme disease risk assessment at Quantico. They examined 113 deer at the MCB Game Checking Station for the presence of deer ticks and collected blood samples to test for Lyme disease antibodies. The Lyme disease spirochete was not found in 47 tested deer ticks but was found in Lone Star ticks, *Amblyomma americanum*, and in winter deer ticks, *Dermacentor albipictus*. Two blood serum samples from Quantico deer tested positive for Lyme disease antibodies. The report concluded that the tick vector and the causative agent of Lyme disease were present at Quantico and that the

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risk for contracting the disease was high for persons who spend much time in the Base woodlands.

7. Hemorrhagic Disease

a. In the early fall of 1996 the Quantico deer herd suffered a severe outbreak of epizootic hemorrhagic disease (EHD). EHD is common throughout the Southeast United States and is the most important infectious disease of the white-tailed deer. EHD is a virus that is transmitted by tiny biting flies in the genus *Culicoides*. Symptoms of the disease are a high fever, swollen head, neck, or tongue and difficulty in breathing. In acute cases deer die within 1 to 3 days of infection (SCWDS 1990). It is more common for deer to become lame, lose their appetite, and become emaciated.

b. The 1996 deer harvest at Quantico dropped over 20% from 1995 and by 1998 the harvest was down over 36% from 1995. Blood samples collected from MCB deer were positive for EHD viral type 2 in 30% of deer. Deer population density is not believed to be a major factor in the severity of the disease. Harvest records suggest that EHD outbreaks at Quantico may be cyclic.

8. Predation. In recent years coyotes (*Canus latrans*), have migrated into the Northern Virginia Piedmont. Signs and sightings of coyotes have become common and the coyote is now well established at MCB. Coyotes will opportunistically prey on white-tailed deer, especially young fawns in the summer. It is unknown what effects, if any, this new predator will have on the MCB deer population.

9. Chronic Wasting Disease (CWD). CWD is a progressive neurological disease found in deer and elk. CWD belongs to the family of diseases known as transmissible spongiform encephalopathies, and is ultimately fatal. There is no evidence that CWD can be transmitted to domestic livestock or humans, but there are still concerns that somehow the agent causing CWD in deer will become pathogenic to humans. CWD has not been found in Virginia but was found in 2005 in West Virginia. The DGIF is maintaining surveillance to monitor any sickly deer for CWD. MCB biologists will maintain communication with military trainers, hunters, and DGIF biologists and will rapidly respond to any reports of sick deer to collect tissues for disease testing. In the event that CWD positive deer are found in northern Virginia, MCB will implement a response plan in coordination with DGIF biologists. The response plan will at a minimum include disease surveillance and public information releases.

10. Mineral Supplementation

a. The provision of supplemental salt and mineral resources is commonly practiced by landowners interested in improving physiological condition and antler development in white-tailed deer. The actual benefit of the practice has been subject to a number of studies, many of which have been inconclusive. However, some studies suggest that

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mineral supplementation (especially calcium, phosphorus and sodium) may provide some benefit in areas with minerally deficient soils (Howard and Murphy 2003). Due to the generally acidic and impoverished soils at Quantico, mineral licks were established in about 1980 at the rate of about 1 per 750 acres and have been replenished annually in February and July.

b. In response to the Chronic Wasting Disease threat to the Commonwealth's deer herd, the DGIF passed regulations in 2006 placing a seasonal ban on the distribution of food, salt and minerals to attract deer. To comply with the feeding ban, MCB Quantico will suspend the placement of mineral supplements in the training areas.

6506. MANAGEMENT RECOMMENDATIONS

1. Habitat Management

a. Forest management practices that are recommended to enhance deer habitat include:

(1) Make small (10-20 acre) scattered regeneration cuts that intersperse young forest stands within a mosaic of mature forest stands and woodland openings.

(2) In loblolly pine stands, use prescribed burning on a 3-5 year rotation to reduce fuel and stimulate herbaceous and woody plant production in the understory. Tolerate occasional hot spots that may open the canopy and promote understory growth. Also, promote precommercial and commercial thinnings to open the canopy and stimulate understory plant growth in 16-39 year old stands.

(3) Within forest compartments, maintain 50% of management area in mast-producing forest (HMHD or PHWD) >40 years of age.

(4) Implement an Integrated Pest Management program (see Chapter 5, Section 6) to help protect oaks and mast production capability of Quantico forest ecosystem.

b. Use appropriate agronomic practices to plant protein rich forage crops in support of multiple land-use objectives. Open range areas, rights-of-way, landing zones, skid trails, and logging decks should be specifically targeted for nutritionally enriched plantings which support erosion control, woody vegetation control, and watershed protection as well as deer management. Only in training areas 14, 15 and 17 is more than 2% of the land area cultivated. Opportunities should be sought to increase the amount of cultivated acreage in the other management areas.

2. Population Monitoring. Track count, winter spotlight, and harvest data should continue to be collected to provide long-term data for monitoring deer population and range condition trends. Harvest data

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should continue to be maintained in a permanent database format for rapid processing and analysis.

3. Harvest Management. A liberal doe harvest should be maintained to harvest bucks and does equally (50:50 ratio). Restrictions on buck harvest by limiting firearms seasons during early rut should continue as a means of maintaining a higher proportion of mature bucks in the herd.

4. Predation. Support ecosystem studies involving factors such as predation, parasitism, and disease that may impact deer populations as well as human use of the Base for training and recreation.

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Fig. 6-13. Deer density estimates West of I-95 from snow track and night count surveys.

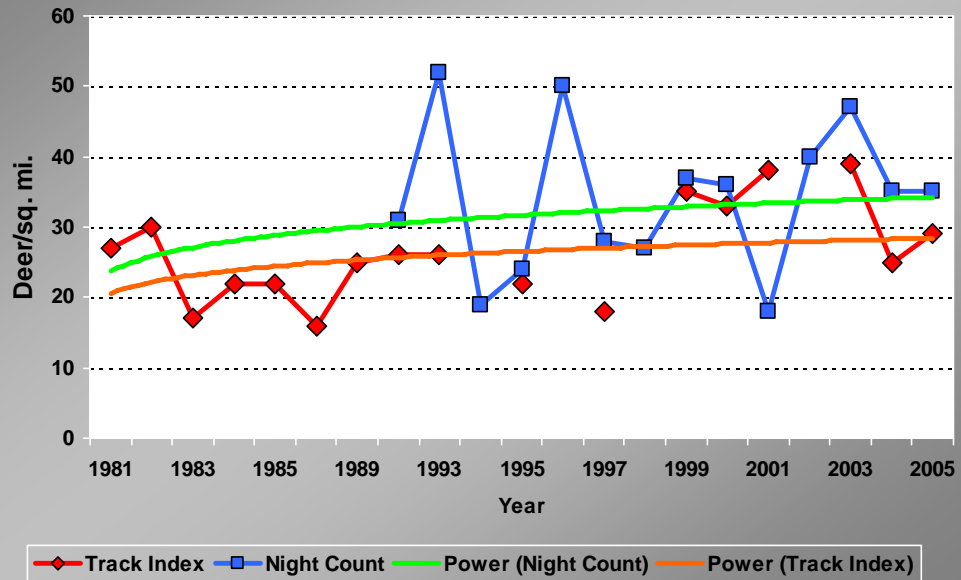
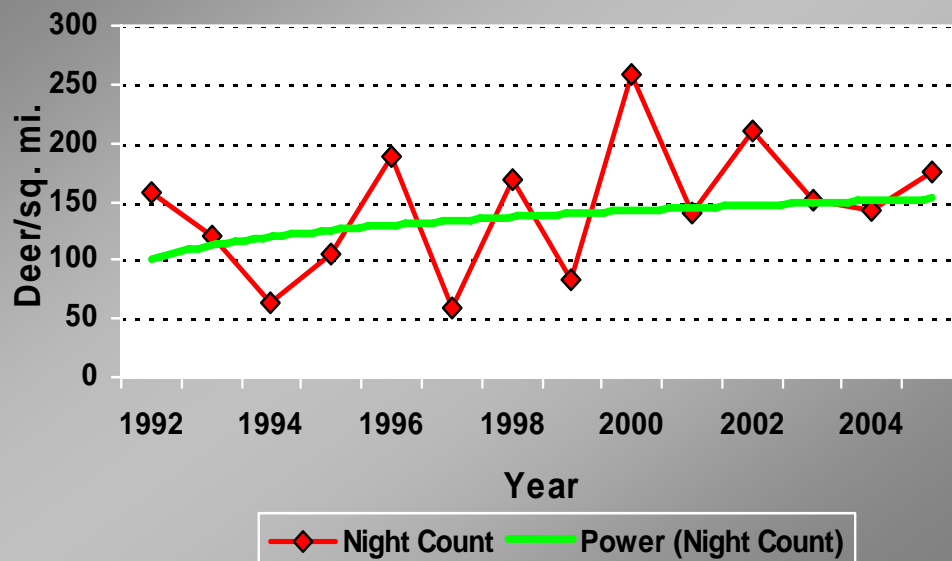


Fig. 6-12. Mainside deer density estimates from night count surveys



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Figure 6-14.--Marine Corps Base, Quantico, Deer Harvest Records

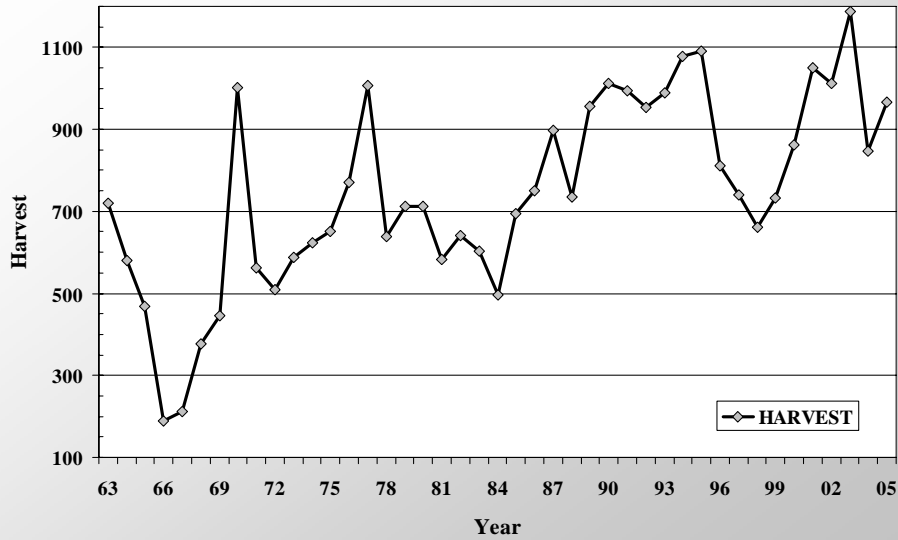
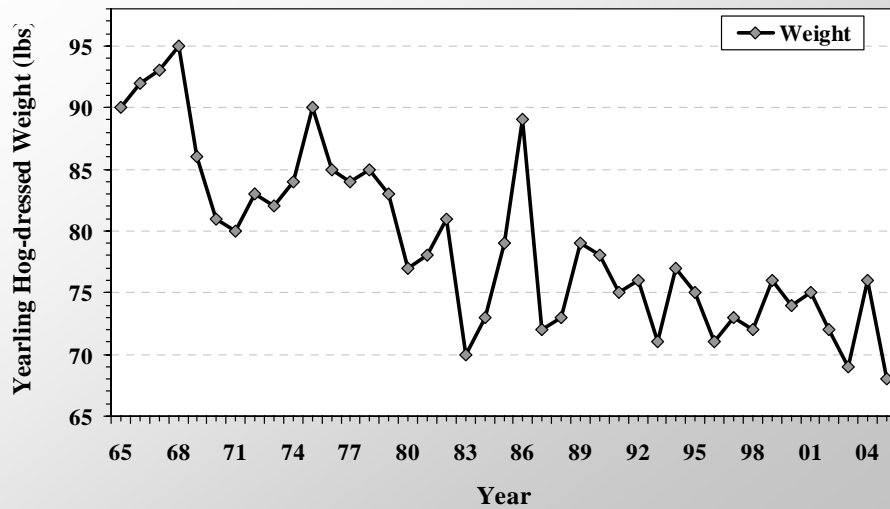


Figure 6-15. Average Hog-dressed Weight of Yearling Bucks and Predicted Range Conditions at Marine Corps Base, Quantico



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Figure 6-16.--Percent Bucks and Does in Deer Harvest

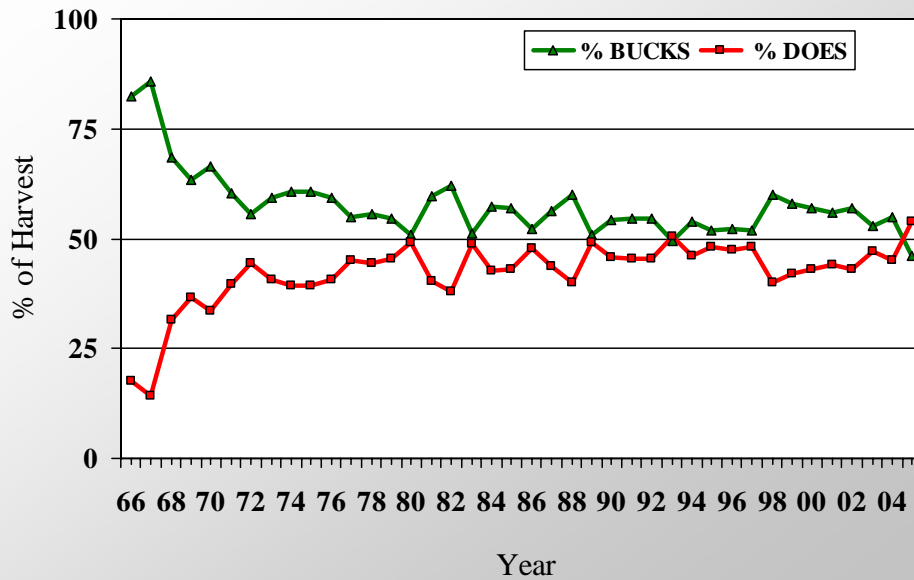
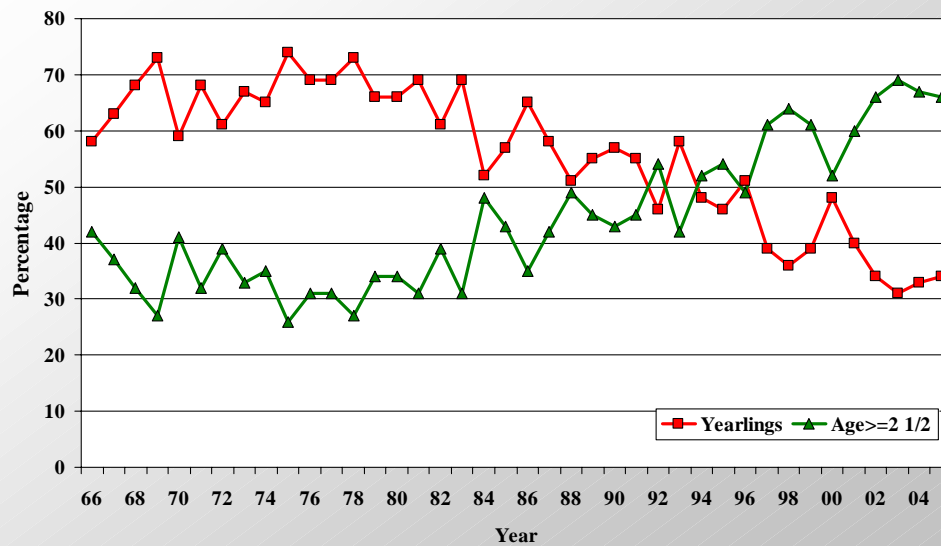


Figure 6-17. Percentage of Yearlings in Adult Buck Harvest



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CHAPTER 6

FISH AND WILDLIFE RESOURCES

SECTION 6: UPLAND SMALL GAME

6600. UPLAND SMALL GAME. Bobwhite quail, mourning doves, cottontail rabbits, ruffed grouse, woodcock and gray squirrels are the upland small game species that occur at Quantico. The primary management objective is to maintain these species as part of the biological diversity of the landscape as well as to support recreational hunting when feasible. Life histories of these species are described in detail at MCB (1997).

6601. BOBWHITE QUAIL. The northern bobwhite (*Colinus virginianus*) was an important game species but has largely disappeared from northern Virginia landscapes over the past two decades. Bobwhites are still found at MCB in small numbers, primarily in and around the fire maintained grasslands near impact areas. MCB wildlife managers consider the bobwhite to be among the most threatened species at Quantico although it has no formal protection status. The primary management objective for the bobwhite is to halt the downward population trend and restore the health of this species. The primary management effort will be directed towards the creation of new quail habitat and connection of existing habitat via the fire-ecosystem management effort described in Chapter 6, Section 2. More intensified population monitoring must be conducted to determine the response of the population to management efforts, and to determine whether more intensive management, such as predator control, could help restore this population.

1. Population Trends

a. Harvest Data. Quail harvest records for MCB are shown at Figure 6-16. Harvest declines after 1972 also occurred at other DoD installations throughout the southeast and suggest a significant bobwhite quail population decline throughout the mid-Atlantic region. Reduced funding for land maintenance programs have resulted in the loss of some early successional habitat. Invasive non-native plants such as tall fescue and sericea may have contributed to reduced habitat values. Greater survival among both avian and mammalian predators over this period may have increased predation rates.

b. Call Count Survey. An annual quail call count route was established at MCB in 1982. Bobwhites were most abundant during the first year of monitoring activity, as 178 "bobwhite" calls were heard during the census period (Figure 6-17). Bobwhite calls declined the following year (43 calls) but since then have remained at relatively stable levels. Hunting harvest trends and call count survey results both suggest a quail decline from 1982 to 1983.

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c. Brood Survey. From 1972 through 1974, field observations incidental to other field activities documented 60 quail broods. Based on the age estimations of the broods and dates of observation, the peak hatching period for quail at MCB was mid to late July but broods hatching as late as 1 October were observed. No written records of quail broods have been maintained since then due to the infrequency of brood observations.

2. Food Habits. Bobwhite diets were examined during fall-winter of 1987. Major food items from the crops of hunter-harvested quail were sorted and identified by the MCB wildlife manager. Bicolor lespedeza was a preferred food, as seeds from this legume were found in every crop examined and dominated the total mass of crop contents (Table 6-7). Quail coveys in the fall and winter are routinely found in or near bicolor hedgerows adjacent to grassland habitat at MCB.

Table 6-7. Crop contents of 9 harvested bobwhites, fall-winter 1987.

FoodItem	Quantity (g)	Frequency
Bicolor lespedeza (<i>Lespedeza bicolor</i>)	29	9
Acorns (<i>Quercus</i> spp.)	13	2
Oats (<i>Avena</i> sp.)	3	1
Korean lespedeza (<i>L. stipulacea</i>)	1	Unknown
Sumac (<i>Rhus</i> sp.)	1	Unknown
Beggarweeds (<i>Desmodium</i> sp.)	1	Unknown
Poor joe (<i>Diodia teres</i>)	>1	Unknown
Panic Grasses (<i>Panicum</i> spp.)	>1	Unknown
Insects	>1	Unknown

3. Habitat Resources at MCB

a. Fire-maintained grasslands near the range impact areas provide bobwhites with the most favorable habitat conditions currently available on the installation. Per the results of bobwhite call counts from 1982 - 2005, the highest and most stable call counts have been recorded at listening stations 6 and 7, which are near fire maintained grasslands at David's Crossroads, Training Area 9A. Based on hunters' observations, quail have largely abandoned the small woodland openings and can only be routinely located at the larger tracts of native grasslands and cultivated fields.

b. Training Areas 9, 10A, 14, and 15 have the most sizeable tracts of these grasslands and may therefore be the most suited areas for quail management at MCB. The fire ecology management plan in Section 2 of this Chapter addresses the connection of existing fire-maintained range areas in order to increase habitat availability for the bobwhite.

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c. About 2,000 acres of grass/shrub/seedling habitat are recorded for the base (Table 2, Chapter 2). An additional 800 acres of semi-developed land are maintained in open condition through combinations of mowing, agricultural planting or prescribed burning practices. Some of the forested land that is less than 10 years of age may also support bobwhite quail populations; the MCB forest management program maintains an average of about 1,000 acres of timberland in stands less than 5 years old.

d. Open areas maintained by agricultural practices usually support bobwhite. In May 1984 and 1985, one-quarter acre sorghum strips were planted in 20 scattered openings known to support quail coveys. In late summer and early fall, quail were found in or adjacent to all of the sorghum patches. It was believed that the patches provided ideal brood habitat because they were comprised of dense overhead cover and open ground cover. In lieu of plantings, strips disked and abandoned in spring will provide good brood rearing cover for quail.

4. Habitat Management

a. Timber Management. The key feature of timber management for quail is that adequate sunlight must filter through the forest canopy to permit the growth of understory shrubs and herbaceous vegetation. Even-aged systems such as clearcuts, seedtree, and shelterwood cuts can result in habitat conditions conducive to bobwhite production if these areas are not too extensive and are properly managed after the initial harvesting operation. A recommended timber management action to enhance quail habitat involves growing pine on a widely spaced 60 year rotation, prescribed burning every other year, and thinning to maintain about 50 square feet of basal area stocking.

b. Cropland, Plantings and Idle Area Management

(1) Although there are no commercially farmed croplands at MCB, some crops are planted in managed openings by the wildlife management program. These habitats are beneficial to bobwhite populations, especially when they are located adjacent to fire-maintained grasslands or woodlands

(2) One of the benefits of planting is that the site preparation often involves disking, which results in desirable brood habitat conditions later in the growing season. Disking alone may stimulate native plant growth, such as ragweed, that provides both fall food and summer brood foraging habitat. Food plantings made specifically for quail can be established as small blocks planted in long rectangular strips. The strips maximize edge and bobwhites are more likely to utilize the entire planted area because food is located in a smaller area close to escape cover.

(3) Cover. If woody cover is limiting, the establishment of bicolor lespedeza strips has been effective. These perennial strips

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are fire adapted and therefore do not need to be protected from either prescribed or wild fires. The above ground stems of bicolor lespedeza are consumed by fire but the plants quickly grow back from heavy underground stems.

(4) Warm Season Grasses. Virginia and other states are promoting the use of warm season grasses (WSG) for pasture management (Capel 1992). Quail, rabbit and songbirds thrive in patches of WSG. They offer better nesting and brood rearing cover and are superior winter cover as well. WSG are perennial species that require little maintenance once established. One recommended species, Indiangrass, grows naturally at MCB and readily colonizes burned areas, especially on moister sites. Broomsedge is a native WSG that normally colonizes abandoned or idle open lands at MCB. It can be maintained by prescribed burning. It is not tolerant of shade and will die if woody vegetation becomes established.

(5) Tall Fescue Control. Tall fescue has invaded many of the semi-developed open land (landing zones and right of ways) at MCB because it is a very adaptable species that is easy to establish and is drought and disease resistant. It has been the recommended species for many maintenance and public works projects. For quail management, it is recommended that tall fescue pastures be converted to WSG or small grain plantings.

5. Harvest Management

a. Healthy bobwhite populations can generally withstand fairly liberal hunting pressure. The MCB and northern Virginia quail population, due to limited and fragmented habitat, has declined in the last 20 years and is not healthy. Quail are extremely sensitive to climatic fluctuations that are beyond the control of wildlife managers. Drought and harsh winters will usually stimulate a significant population decline despite the efforts of wildlife management. The MCB population is vulnerable and hunting was curtailed in 2001. The intent is to reopen hunting when a more viable quail population exists.

b. The harvest rates at MCB from 1990-2000 were estimated to be less than 10% of the estimated population size. Some coveys have disappeared from apparently suitable habitat even though the coveys were not hunted. While hunter harvest is not believed to have contributed to the decline, the low population levels now do not provide a harvestable surplus of birds.

6. Management Recommendations

a. Fire Ecology Corridor. Bobwhite quail management must be conducted in coordination with other land uses. Therefore, training areas suited for quail management should have large tracts of open areas or have potential for the creation of open areas, and should be available for the use of prescribed burning. The fire ecology

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management area described in Chapter 6, Section 2 should create and maintain excellent quail habitat.

b. Firebreaks. A disking maintenance plan for earthen firebreaks should be used to promote the development of quail brood rearing cover. Abandoned tracked vehicle routes through the fire ecology corridor should be stabilized and maintained as firebreaks and brood habitat strips.

c. Forest Management. In the fire ecology corridor and adjacent to ranges where fires are expected, the management of pines per the alternative stated in 6601.4.a. may help produce savannah-like conditions preferred by quail.

d. Maintain Open Areas. Since bobwhite populations require early successional vegetation, it is important to maintain open habitat. Coordinate with Range Management Branch, G-3, Facilities Logistic Support Section, G-5, and Public Works Branch, G-5, on all planting projects done in the training areas. Emphasis must be placed on establishing plantings that support training and benefit wildlife.

e. Fescue Control. Fescue must be eliminated from managed openings in the Training Areas. Glyphosate applications are recommended.

f. Disking. In managed fields in or near the fire ecology zone, install disk strips in fall or early spring to serve as summer brood habitat.

g. Population Survey. The DGIF June whistle (call) count should be conducted annually on the established MCB survey route. In addition, a base-wide call count census should be conducted in order to map which habitats at MCB are occupied by calling birds and to monitor any increases or declines in occupied habitat.

h. Predator Control. Consideration should be given to the trapping of mammalian predators from the fire ecology zone in an attempt to enhance nesting success.

6602. MOURNING DOVE. The mourning dove (*Zenaida macroura*) is a common resident species at MCB. Besides being an important component of the avian community, the dove is an important game bird in Virginia and provides recreational hunting opportunities.

1. Mourning doves nest in a variety of habitats but are generally associated with forest edges and disturbed areas. Courtship activities have been observed at Quantico from February through September. Clutch sizes range from 1 to 3 eggs, with 2 being the average (Keeler 1977). The incubation period averages 14 days and parents share incubation responsibilities. Doves can raise multiple broods during a breeding season. Mourning doves leave breeding

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habitats and begin their fall migration with the onset of fall weather around the first week of September. At MCB, large flocks of mourning doves form around small grain fields beginning in August. Doves use these grain fields intensively for feeding until early September, at which time dove numbers rapidly decline due to migration.

2. Management Practices. Because early successional habitats are the most productive dove areas, the overall acreage of improved, semi-improved and early successional forestland will have the strongest positive influence upon the mourning dove population.

a. Agricultural fields are important because they furnish doves with a reliable source of food. At MCB, most agricultural fields are multiple-use facilities serving as landing zones, drop zones, sludge application areas, or mechanized training sites. Most cultivation needs to be restricted to crops that have a low growth height so that visibility for military training is not impaired. Also, MCB soils are generally acidic, infertile, and highly erodible, making corn production dependent upon above average rainfall and difficult during a drought. Past experience has shown that small grains, such as wheat and millet, rotated with soil enriching legumes such as ladino clover, help to maintain the fertility and stability of MCB soils and provide some summer grain attractive for doves. Sunflower and corn are preferred by doves but are more difficult to grow, corn because of drought, sunflower because of losses to deer predation.

b. At MCB, dove flocks have used fields ranging in size from four to 40 acres during the late summer. Fields of any size are utilized for courtship and nesting purposes.

c. Woodland. Although mourning doves rely on trees for nesting and roosting habitat, forest and woodland interiors are not heavily utilized. Large tracts of undisturbed forest are not attractive to doves. Silvicultural practices that open up the forest and result in the creation of substantial amounts of edge will improve mourning dove habitat conditions significantly. Thus, habitat management zone 1 (see Section 2) and the fire-ecology management area will provide more dove habitat than other management zones at MCB.

d. Harvest Management. Since mourning doves are migratory, harvest management guidelines are developed and implemented on a flyway-wide basis. The USFWS is responsible for establishing flyway harvest quotas. State wildlife agencies are then permitted to enact specific harvest recommendations for their respective states so long as daily bag limits do not exceed those established by the federal government. MCB will plan to implement the dove hunting seasons established by DGIF.

3. MCB Historical Data. Hunter harvest records are provided at Figure 6-18. These records reflect the amount of grain plantings done to attract doves and are not believed to be related to nesting densities. A substantial resident breeding population is believed to

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have existed in all of the years despite the greatly fluctuating harvest records.

4. Management Recommendations. Virtually all of the management practices recommended for bobwhite quail habitat will also benefit mourning doves and therefore will not be restated. The open areas listed in Appendix A that exceed four acres are large enough to support summer feeding flocks and therefore should have small grain crops included in the agricultural rotations.

6603. AMERICAN WOODCOCK. The American woodcock (*Scolopax minor*) is a popular upland game bird found in early successional forests throughout the Base. MCB is located within both the wintering range and the principal breeding range of the woodcock. Although woodcock populations along the Atlantic coast have been declining during the last two decades based on U.S. Fish and Wildlife Service (USFWS) estimates, woodcock are relatively abundant at MCB during the fall migration. Management objectives at MCB are to maintain breeding and wintering habitat in support of regional population recovery objectives and to sustain opportunities for recreational hunting per USFWS/VDGIF guidelines.

1. Habitat Requirements. Woodcock are closely associated with young, second-growth hardwoods but need a diversity of forested, shrubby, and open habitats to satisfy their life requirements. Male woodcock establish breeding territories (referred to as singing grounds) in relatively open fields containing scattered brush, small trees, or shrubs. Courtship flights have been observed in forest clearings, pastures, cultivated fields, young pine plantations, and other open sites.

2. MCB Historical Data

a. DGIF Woodcock Study, 1974-76

(1) Results of fall flushing counts from 1974-1976 documented the peak of fall migration to be from the last week of October to the first week of November, depending upon weather fronts to the north. After the hunting season opened in November, the number of woodcock declined but continued to be fair until early December, at which time woodcock became scarce.

(2) Moist bottomland with low brush cover near streams was the habitat selected most often by fall migrants. The brush cover in these locations ranged from sparse to dense and from 8 to 15 ft tall. As in more northern states, alder (*Alnus serrulata*) appeared to be a favorite covert. Other species used for cover included flowering dogwood (*Cornus florida*), blackberry (*R. alleghensiensis*), small maples (*Acer spp.*), ash (*Fraxinus spp.*), willow (*Salix spp.*), spicebush (*Lindera benzoin*), other small shrubs, and thickets of Japanese honeysuckle. (Taylor 1977).

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(3) Breeding males were observed during early February, with good concentrations occurring in late February of each year; the highest numbers of singing males were recorded during the last week of February and the first week of March. Many singing grounds remained occupied until late May. These records document the presence of a substantial woodcock breeding population at MCB.

(4) Woodcock nest data were gathered from all recorded sightings from 1973 to 1976. Most nests were found in small brushy patches of bicolor lespedeza, blackberry, sumac, and other hardwood species with stems from 1/2 in. to 3/4 in. in diameter. All were within 50 to 60 ft of open clearings, fields, road shoulders, or mowed rights-of-way. Estimated hatching dates varied from mid-March to late-June; most hatching occurring during the first two weeks of April (Taylor 1977).

b. Harvest Data. Harvest data for 1962 through 2005 are shown at Figure 6-18. The harvest has experienced a downward trend from approximately 300 birds/season in 1977 to less than 50/season since 1986. This decline is not due so much to a reduction in woodcock numbers but to the regional reduction in numbers of upland game bird hunters. Urbanization, loss of habitat, and loss of quail hunting opportunity has greatly reduced the number of hunters who own bird dogs and pursue upland game birds.

3. Management Recommendations

a. Habitat Management. Woodcock management should provide the following habitat components: (1) openings for courtship, (2) young, second-growth hardwoods near openings for nesting and brood rearing, (3) alders or dense stands of hardwoods for diurnal feeding cover, and (4) large fields for diurnal roost sites. Ideally these habitats should be closely interspersed. The habitat management plan in Section 2 should provide these woodcock habitat requirements. A sufficient amount of forestland must be maintained in an early successional stage, especially in riparian non-mast producing hardwood (NMHD) stands. It is recommended that selected NMHD stands be clearcut in 100 ft wide strips separated by uncut strips, or else be selectively harvested to provide older trees for cavities and young patches for woodcock coverts.

b. Management of Openings. A diversity of openings should be maintained for use by woodcock. These sites should be maintained in an early successional stage by burning, mowing, and/or bush-hogging every 2 to 3 years. Logging and open land maintenance programs are required to provide scattered openings.

6604. RUFFED GROUSE. The ruffed grouse is a common native game bird of the Appalachian Mountains and adjacent foothills. MCB is located east of the normal grouse range but does harbor a very small population of ruffed grouse. During the late 1960's, ruffed grouse

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flourished at Quantico and became an important game bird for about 10 years. Since that time the grouse population has declined to an almost undetectable level. It would be desirable to reestablish a thriving population as witnessed during the 1970's; however, at this point in time, to retain the ruffed grouse as part of the Base's natural heritage is the first priority. Current ruffed grouse management objectives are to: (1) monitor the population size to detect any significant improvements from current numbers; and (2) ensure early successional forest habitat is maintained.

1. Drumming Counts. A primary population monitoring technique for ruffed grouse is the drumming count, whereby vehicle-borne observers count the number of drumming males along predetermined census routes (Thompson and Moulton 1981). Counts usually begin 1/2 hour before sunrise and are conducted during the mating season. Some survey work is needed to determine the optimum time period for drumming grouse counts at Quantico. Drumming grouse have been heard early in April during spring gobbler counts but it is believed that the gobbler counts may occur too late in the season for ruffed grouse.

2. Archery Hunters Survey. In 2005, archery hunters at Quantico had to complete a questionnaire at the end of each hunt, listing the wildlife species that they had seen. There were 9 reported observations of ruffed grouse, documenting the existence of small numbers of the bird.

3. Habitat Management

a. Throughout its range, the ruffed grouse is dependent upon early and mid-seral deciduous forest succession. As a result of this dependency, ruffed grouse management is virtually synonymous with active timber harvesting. Short timber rotations are beneficial to grouse, although effective management can be achieved by implementing sawtimber rotations. Clearcuts larger than 40 acres in size are not recommended. Even-aged forest management on an 80 to 100 year rotation, with a 10-year cutting cycle on sites ranging from 2 to 20 acres in size is an economically sound approach to grouse management (Stoll and Honchul 1983). This cutting scheme will also provide continual brood and other habitat types. After approximately 10 years the brood habitat value of regeneration cuts begins to decline (USDA 1971). By following this or a similar harvest strategy, grouse habitat will be continually renewed.

b. On a smaller scale, pruning, releasing, and fertilizing fruit and nut trees commonly found around former home sites is a worthwhile grouse management practice (USDA 1971). Release cuts are also useful in areas where desirable understory species such as grape or hawthorn are present.

c. The seeding of logging roads and log decks to grasses and clover following timber harvest is a beneficial practice to improve brood habitat.

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4. Habitat Resources At MCB. Mature upland forest stands and older conifer plantations probably support few ruffed grouse because these communities do not provide sufficient amounts of the dense early successional cover necessary to sustain grouse populations. Abandoned fields having seedling/shrub cover and 1-30 year old timber stands furnish some of the best habitat conditions conducive to grouse production at MCB. The only training areas having a significant amount of these habitat types are 14 and 15. The majority of drumming grouse recorded during the last 10 years were heard in these training areas.

5. MCB Historical Data. MCB ruffed grouse harvests are plotted at Figure 6-16. Grouse were never very abundant and the population apparently dropped precipitously after 1982. Since 1984, natural resources personnel have reported no grouse broods. Occasional drumming grouse are heard in the spring and flushes are reported on occasion from widely scattered areas of the Base. Historically, old homesites were some of the best ruffed grouse sites on Base. These old homesteads contained relic fruit orchards, gardens, dense honeysuckle thickets, and open grassy areas. Although many of these sites are less than one acre in size, the release or replanting of fruit trees and maintenance of small openings may be useful in supplying grouse with the specific seasonal habitat needed for brood cover.

6. Management Recommendations

a. Forest management practices recommended for woodcock also will produce desirable grouse habitat. Training areas 9, 14, 15, 17, and edges along the fire-management areas are probably most suited for early successional forest management for ruffed grouse.

b. Grouse should not be hunted at MCB until population recovery is made but dog training within published guidelines is permissible.

c. Drumming Count. A drumming count should be conducted either separately or concurrently with the spring gobbler count. Effort should be made to train all spring gobbler survey personnel in the identification of ruffed grouse "drumming" sounds. Effort should be expended to determine the best time of year to conduct the drumming count at MCB.

6605. GRAY SQUIRREL. The gray squirrel (*Sciurus carolinensis*) is a popular game species that can be very abundant in the oak/hickory forests found at Quantico following years of good mast production. Bottomland hardwoods, upland hardwoods, and upland mixed pine hardwood forests provide the best habitat components for gray squirrels. Squirrels make heavy use of pine seeds during years of oak mast shortage; therefore, mature cone-producing pine stands may also be important to squirrels, particularly in years when acorn production is poor. Management objectives are to maintain adequate acreage of

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mature mast producing trees, such as those listed at Table 6-8, to provide food and denning resources for squirrels.

1. Population Densities

a. Gray squirrel populations may exhibit significant fluctuations from year to year, but they are not considered cyclic. Fluctuations are generally correlated with the availability of hard mast food supplies during the preceding fall. Fall-to-fall densities have been observed to double or even quadruple in response to bumper crops of mast, and they have been observed to plummet to population levels of 15% to 25% of the previous fall density in response to mast crop failures (Nixon and McClain 1969, Barkalow et al. 1970). These trends of fluctuating abundance are very apparent at Quantico as displayed by the squirrel harvest data shown at Figure 6-19.

b. Scientific literature reports gray squirrel fall population densities ranging from approximately 0.25 to 1.3 squirrels/acre for extensive forested habitats (Mosby 1969, Nixon and McClain 1969, Barkalow et al. 1970). At Quantico, there are over 53,000 forest acres, of which over 37,000 acres exceed 40 years of age and are believed to produce mast and seed crops useable by squirrels. Using population densities ranging from 0.25 to 1.3, it is estimated that the MCB fall squirrel population ranges from 9,300 to 48,700 animals.

2. Food. Table 6-8 shows primary and supplemental food items for gray squirrels based on several studies. Although population levels are closely tied to the availability of hard mast (Nixon et al. 1975), supplemental foods are often heavily utilized when available (Baker 1944). The hard mast production capability of a timber stand is the key that determines a stand's ability to support gray squirrels. Shaw (1971) assumed that a hard mast production rate of 100 lb/acre would be sufficient to support 0.3 to 0.5 squirrels/acre when the needs of other game and nongame species were considered. Nixon et al. (1975) estimated that a higher rate of 130 lb of hard mast/acre was the minimum production required to support densities of 1 squirrel/acre and, if possible, hard mast production should exceed 150 lb/acre. If 150 pounds of acorns per acre is considered quality squirrel habitat (≥ 1 squirrel per acre), then it appears that MCB hardwood forests can be predicted to reach that level of production at between 50-60 years of age. Mixed pine-hardwood stands can be predicted to reach that production level at about 70 years.

3. Nest Sites. A reasonable management goal for nest sites is 2.4 to 3.2 sound dens/acre (Nixon et al. 1980), but up to 6 sound dens/acre may be practical in stands with high hard mast production (Sanderson 1975). A variety of tree species should be retained in each stand, as different species decay and develop dens at varying rates (Sanderson 1975). Sound dens may take from 8 to 10 years to form and may have useful lives of 10 to 20 years.

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Table 6-8. Primary and supplemental plant foods available at Quantico that are commonly used by the gray squirrel (Barber 1954, Uhlig 1955, Davison 1964, Nixon et al. 1968).

PRIMARY PLANT FOODS

Hickories (<i>Carya</i> spp.)	Yellow poplar (<i>Liriodendron</i>
Oaks (<i>Quercus</i> spp.)	<i>tulipifera</i>)
American beech (<i>Fagus grandifolia</i>)	Fungi
Maples (<i>Acer</i> spp.)	Flowering dogwood (<i>Cornus florida</i>)
Blackgum (<i>Nyssa sylvatica</i>)	Black walnut (<i>Juglans nigra</i>)

SUPPLEMENTAL FOODS

American hornbeam (<i>Carpinus caroliniana</i>)	Greenbrier (<i>Smilax</i> spp.)
Ash (<i>Fraxinus</i> spp.)	Hazelnut (<i>Corylus americana</i>)
Blackberry (<i>Rubus</i> spp.)	Black cherry (<i>Prunus serotina</i>)
Blueberries (<i>Vaccinium</i> spp.)	Persimmon (<i>Diospyros virginiana</i>)
Pine (<i>Pinus</i> spp.)	Sweetgum (<i>Liquidambar styraciflua</i>)
Sycamore (<i>Platanus occidentalis</i>)	Chinquapin (<i>Castanea pumila</i>)
Grapes (<i>Vitis</i> spp.)	

4. Timber Management

a. Stands of oaks and hickories may be thinned periodically to promote crown vigor, thus improving mast production potential. Small selection cuts (without cull tree removal) that create openings of 0.25 to 1.0 acre are less disruptive to squirrel populations than are clearcuts. During these selection cuts, a stocking rate of 15 to 20 oaks of 10+ in. dbh and 15 to 20 similarly sized hickories (6 to 8 trees/acre of each genera) should be retained to provide enough mast to maintain fall densities of approximately 1 squirrel/acre. Approximately 2 to 3 trees/acre with suitable den cavities, including some large-diameter den trees (23.6+ in. dbh), should be retained for shelter (Nixon et al. 1980).

b. Clearcut stands should be kept small (<20 acres) and 40% to 60% of the management unit should be retained in stands with trees of mast-producing age (Shaw 1971). Management units should be regenerated in a pattern where young stands (20 to 25 years old) are not contiguous to each other. Nixon et al. (1975b) suggested that 8 to 10 suppressed hickory poles per acre (3 to 6 in. dbh) be left standing in clear-cuts. Although some of these trees will die, some should live and reach seed-bearing size, thus improving the habitat for squirrels as the stand matures. A number of healthy understory trees that produce supplementary squirrel foods should also be retained in clearcuts; a minimum basal area of approximately 2 to 3 sq ft/acre is recommended (Nixon et al. 1980).

5. Habitat Resources At MCB. Hardwood and mixed pine-hardwood forests throughout MCB provide quality squirrel habitat. Based on the MCB forest inventory, there are 29,193 acres of mast-producing hardwood forest, 2,607 acres of non-mast producing hardwoods (riparian

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zones), and 8,847 acres of mixed pine hardwoods. It is predicted that at 40 years of age these forests begin to provide enough hard mast and denning sites to support gray squirrel populations. About 31,150 acres, or 58% of the total forested acreage at MCB, meets this criterion. About 24,000 acres at MCB are either HMHD \geq 60 years or PHWD \geq 70 years. These habitats are considered high quality squirrel habitats and comprise about 45% of the total MCB forestland.

6. Management Recommendations

a. No specific actions for squirrel management are required. The management actions for land management Zones 2-6, described in Section 2, should produce large blocks of mature mast-producing forest supportive of healthy squirrel populations.

b. Oak Mast Count. Continue monitoring acorn production using the standardized acorn production count that is currently in use.

6606. COTTONTAIL RABBIT. The eastern cottontail (*Sylvilagus floridanus*) is an important mammal, serving as an important prey species to wild raptors and carnivores and also as a significant game species in Virginia. The eastern cottontail occurs throughout the eastern half of North America, where it occupies agricultural habitats and other early to mid-successional plant communities. Management objectives are to manage vegetative communities to improve habitat and maintain the cottontail population.

1. Historical Data. Rabbits, along with quail and grouse, have declined at MCB over the past 30 years, although rabbit populations currently seem much more viable than the grouse or quail populations. Harvest data indicate an abrupt population decline during the 1970's and the maintenance of a low-level population since that time (Figure 6-16). Summer roadside count surveys, winter track counts, and incidental observations by installation personnel also indicate poor rabbit populations. It should be noted that cottontail harvest trends are almost identical to those for bobwhites. This similarity may indicate that whatever is responsible for the MCB quail decline is also responsible for the rabbit decline. Habitat deterioration due to aging forests, succession of old field habitats into forested habitat, and planting of tall fescue in training areas may have contributed to habitat decline. It is likely that other factors are also involved in the rabbit/quail decline and may involve disease and increased predation. Most likely, all of these factors have combined to prevent rabbit populations from rebounding to previous high levels.

2. Census Techniques. At MCB, roadside counts have been done in conjunction with annual quail call counts. The technique consists of driving predetermined routes in the evening or early morning and counting rabbits. The roadside count made at Quantico is done in conjunction with the annual quail call count and is only conducted one morning, resulting in a very small sample size of rabbits observed.

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3. Habitat Management

a. Because cottontail habitat requirements are so similar to those of bobwhites, active quail management will likely benefit resident cottontail populations as well. Rabbits require an interspersed of both early and mid-successional habitat. Rabbits need horizontal cover of woody vegetation and vines to help protect them from predators. Young forests may be made more attractive to cottontails by maintaining strips of dense shrubs and vines, such as blackberries, at intervals throughout the plantation. Networks of these strips may function as corridors, connecting pine plantations with more superior habitats. Prescribed burning can help to retain pockets of grass and seedlings within pine plantations.

b. Idle Area Management. Many of the same management practices used to improve idle areas for bobwhite production will also maintain or improve idle areas for cottontails. Late-winter or early-spring prescribed burns, shrub plantings, brush-pile establishment, and strategically placed disked strips will result in habitat conditions favored by both bobwhites and cottontails. Though both rabbits and quail rely heavily on dense woody vegetation for escape and thermal cover during winter, rabbits are probably more dependent on woody vegetation because shrubs and vines often make up the bulk of a cottontail's winter diet.

c. Mowing. Extensive mowing operations, performed during inappropriate seasons, can have deleterious effects on rabbit populations. Where cottontails are a central management concern, mowing should be conducted on small parcels of land after the breeding season during late summer and early fall. An ideal habitat management scenario would involve harvesting strips of vegetation from a managed opening rather than an entire removal operation. Mowed strips should be located adjacent to dense brush so that rabbits have escape cover, foraging habitat (mowed strip), and nesting habitat (unmowed strip) all in proximity to one another.

4. Management Recommendations

a. Habitat Management. The fire-ecology zone described in Section 2 holds the most promise for rebuilding quality quail and rabbit habitat.

b. Ensure that all planting done in conjunction with construction and range maintenance activities in these training areas utilize warm season grasses, small grains and legumes that support quail/rabbit habitat.

c. When compatible with other land management purposes, use strip mowing as opposed to total mowing to diversify habitat within fields.

d. Diversify forest clearcut units by breaking up large pine plantations with hedgerows. Rather than piling slash into piles for

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burning, the slash may be pushed into hedgerows that could remain unplanted; besides providing immediate escape cover, vegetative growth along the hedgerows would naturally succeed through species such as pokeberry, blackberry, sumac, honeysuckle, and then woody saplings. This transition would serve to maintain more diversity within the clearcut than if 100% of the space is planted to pine.

e. Eliminate or control tall fescue (Kentucky 31) in these training areas through glyphosate application and cultural treatments.

f. Predator-Prey Study. The scientific study of predator-prey relations and efficacy of predator controls should be done to evaluate if mammalian predator control could contribute to the recovery of small game species.

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Figure 6-16. Quail, Rabbit and Grouse Harvest Records

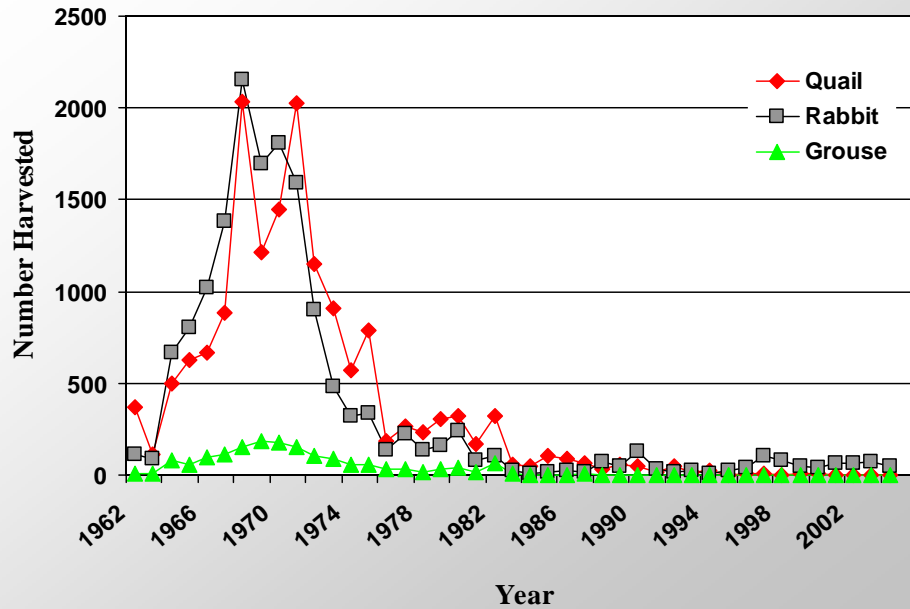
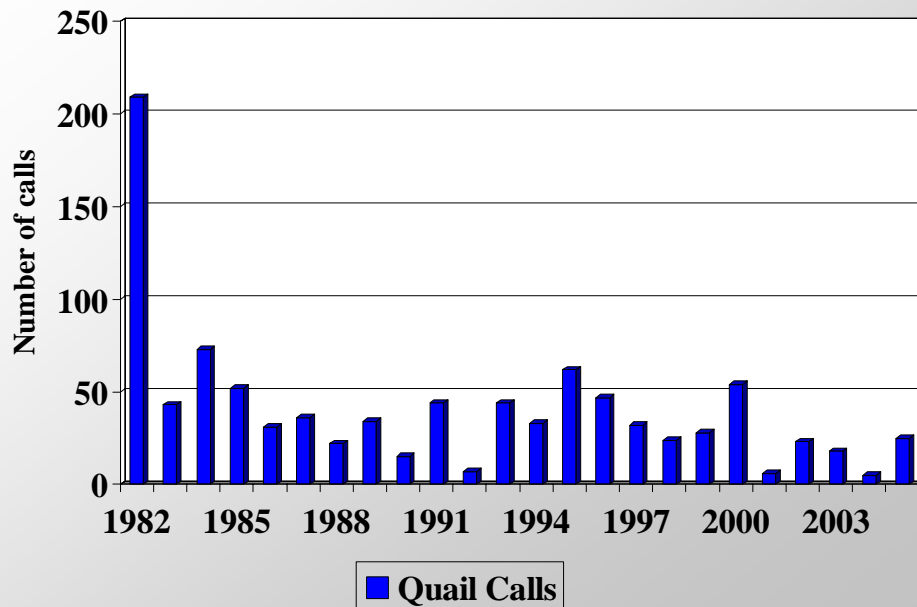


Figure 6-17.--Bobwhite call counts on standardized route



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Figure 6-18.--Dove and Woodcock Harvest Records

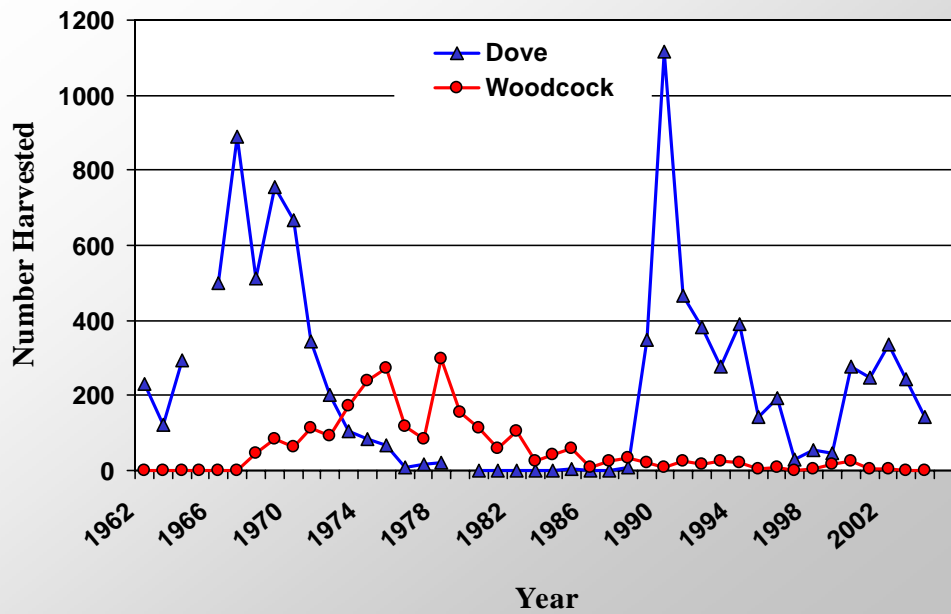
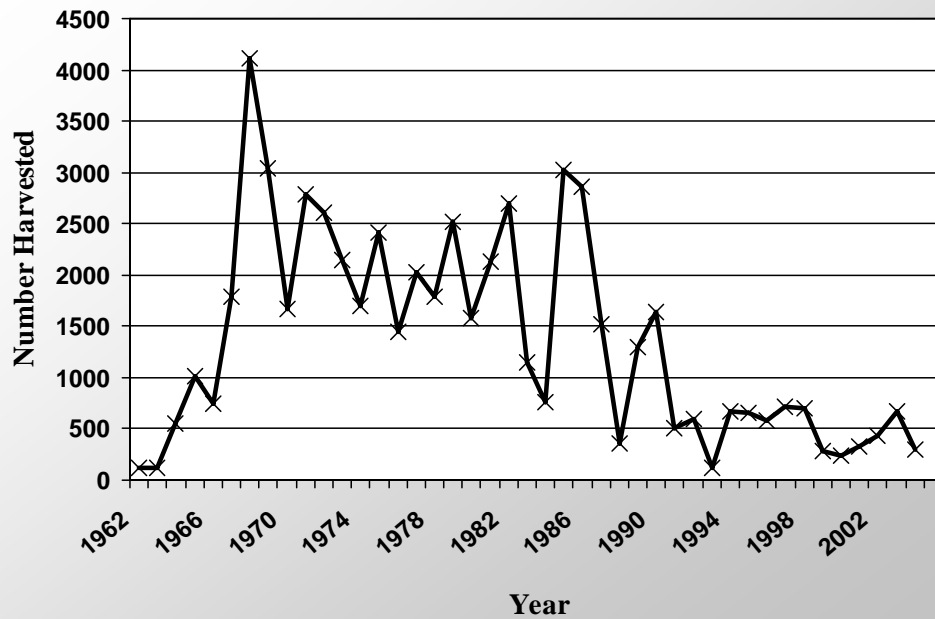


Figure 6-19. Squirrel Harvest Records



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CHAPTER 6

FISH AND WILDLIFE RESOURCES

SECTION 7: FURBEARER MANAGEMENT

6700. MANAGEMENT GOALS. The beaver (*Castor canadensis*), raccoon (*Procyon lotor*), muskrat (*Ondatra zibethicus*), river otter (*Lutra canadensis*), mink (*Mustela vison*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), striped skunk (*Mephitis mephitis*), coyote (*Canis latrans*), and opossum (*Didelphis marsupialis*) are the primary furbearing species found at the Marine Corps Base, Quantico (MCBQ). The coyote is only a recent arrival, becoming common since 1995. Although these species historically were trapped for their fur, their economic significance and recreational importance has diminished in recent years due to the decline in the fur market. These species have ecological significance as natural predators, disease vectors, and in the case of beavers, as vegetation and water level managers. Water impounded by their actions can increase wetland area and improve habitat for waterfowl and other wetland wildlife; on the other hand, clogged culverts can result in road flooding and costly repair and maintenance work. Some of the species, such as raccoons, skunks, and foxes are implicated for predation on nests and young of songbirds and game species. The goal of furbearer management is to sustain predators at levels that do not imperil other declining species and to diminish the risk of disease outbreaks and damage complaints.

6701. LIFE HISTORIES

1. Beaver

a. The beaver occupies slow-moving freshwater habitats and is found throughout MCBQ wherever reliable water supplies are found. Females produce 1 litter of 3 to 4 kits per year (Novak 1977, Wigley et al. 1983). The kits are incorporated into the family unit, which typically includes the adult pair and siblings from the previous year's litter. This family unit is generally called a "colony." The average number of individuals in a family group in the United States is 5.2 (Denney 1950). Densities have been reported to range from 0.8 families/miles of stream in New York (Buckley 1950) to 1.2 families/mile of stream in Alabama (Hill 1976).

b. The beaver's diet is largely composed of vegetation that grows on moist soils. Woody vegetation is a vital component of beaver habitat. Trees and shrubs are not only important dietary items, but are essential materials for dam and lodge construction. Woody plants are especially important during winter when herbaceous food availability is limited (Allen 1982). Tree and shrub limbs are cut and stockpiled in underwater "caches" to provide winter food. Beavers consume the leaves, twigs and bark of woody vegetation but display preferences for certain species and size-classes (Jenkins 1979). At MCBQ, aspen (*Populus tremuloides*), yellow poplar (*Liriodendron*

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tulipifera), and sweet gum (*Liquidambar styraciflua*) are important food species but almost all trees species near water are used. Herbaceous plants favored by beavers include evergreen Christmas fern (*Polystichum acrostichoides*), sedges (*Carex* sp.), duck potato (*Sagittaria* spp.), pondweed (*Potamogeton* spp.), and water lily rhizomes (*Nymphaea* spp.) (Svendsen 1980). Beavers usually exploit food closest to the water first and then range farther as this supply is depleted.

2. Raccoon

a. The raccoon is one of the most ecologically tolerant furbearers in terms of its habitat requirements. Raccoons are found throughout MCB. Raccoon breeding season extends from late winter to early spring. February is generally considered to be the month of peak activity. The average litter size is 3 (Edwards et al. 1992).

b. Raccoons consume a tremendous variety of foods, including meat carrion, garbage, birds, mammals, a host of plant species, and almost any food prepared for human or animal consumption. Hard and soft mast are foods of choice. Agricultural crops, especially corn, can be of local importance (Giles 1940). Since raccoons are closely associated with water, aquatic vertebrates and invertebrates comprise a significant portion of their diet. Raccoons display a marked preference for crayfish. Frogs, turtles, snakes and their eggs, fish and mollusks are common food items (Dearborn 1932, Edwards et al. 1992). Insects, particularly beetles (Llewellyn and Uhler 1952) and grasshoppers, are also common foods. Raccoons are adept at locating and consuming waterfowl nests.

3. Red and Gray Foxes

a. Red and gray foxes are both common species at MCBQ. Throughout much of their range, they display distinct habitat preferences. Grays favor deciduous woodland habitats (Fritzell 1987) while reds are more commonly linked with agricultural lands (Voigt 1987). Although there are few agricultural lands at MCBQ, red foxes are found throughout the Base, even in training areas with little open land. Yearling females of both fox species are capable of producing a litter annually (Harris 1979, Fritzell 1987). Breeding takes place in December through March among red foxes and January through April in grays (Edwards et al. 1992). The average litter size is 5 pups for red foxes and 4 pups for grays. In both cases pups remain with their parents until the fall of their first year (Edwards et al. 1992).

b. Both red and gray foxes are highly susceptible to rabies. At Quantico, red foxes frequently are infected with sarcoptic mange, caused by the mite, *Sarcoptes scabiei*. Infected animals become emaciated, lose hair, and their skin becomes crusty and flaky in appearance. This is the most common disease of red foxes and may cause significant mortality. Gray foxes are not susceptible to sarcoptic mange but are very susceptible to canine distemper, which causes significant mortality in grays.

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c. Food habits

(1) Red and gray foxes are opportunistic, non-specific predators in that they eat a broad array of foods. Small mammals, birds, reptiles, amphibians, and their respective eggs are readily consumed by both fox species (Edwards et al. 1992). Insects, especially grasshoppers and crickets often make up a substantial part of the spring and summer diets of foxes (Fritzell 1987, Edwards et al. 1992). In addition to live animals, foxes will readily consume both wild and domestic carrion when available. Voigt (1987) reported that white-tailed deer and livestock carrion were of local importance to red fox populations during winter.

(2) Generally, both species prefer deciduous fruits such as apples (*Malus* spp.), pears (*Pyrus* spp.), persimmons (*Diospyros virginiana*), blackberries, and grapes (Hockman and Chapman 1983, Edwards et al. 1992). Acorns, grasses, sedges, and domestic grain crops are consumed when available.

4. Mink. Mink reside in an assortment of wetland habitats including freshwater and saltwater marshes and along streams, rivers, and lakes (Eagle and Whitman 1987). Shoreline areas with adequate concealment cover are preferred. Primary mink habitats at Quantico include the lower Chopawamsic Creek tidal area and the Cedar Run floodplain. However, mink are very scarce as only one has been reported by trappers since 1985.

5. River Otter

a. Historically, river otters occupied aquatic ecosystems across North America. Victims of habitat degradation, over harvest and human encroachment, otter populations declined (Melquist and Dronkert 1987) or were extirpated in some regions. The river otter is found at MCBQ in scattered locations at beaver ponds and reservoirs.

b. Upon reaching sexual maturity at 2 years of age, otters mate in late winter or early spring (Edwards et al. 1992). The average litter consists of 2 or 3 blind, helpless pups. The pups will be weaned at 3 months of age and become self sufficient in 5 to 6 months (Edwards et al. 1992). The female and her offspring usually remain together for 7 or 8 months or until the birth of a new litter is imminent (Melquist and Hornocker 1983).

c. Fish are the mainstay of the otter diet (Melquist et al 1981, Cooley 1983), though a variety of aquatic vertebrates and invertebrates, birds, and mammals are opportunistically consumed (Edwards et al. 1992).

6. Muskrat. Muskrats require a permanent water supply. They can be common in the tidal marshes of Chopawamsic Creek but otherwise are relatively uncommon at MCBQ. Like beavers, muskrats are largely herbivorous (Edwards et al. 1992). Muskrats consume a vast array of wetland vegetation. Cattails (*Typha* spp.) and bulrushes (*Scirpus* spp.) are preferred items, often constituting up to 80% of the

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animal's diet (O'Neil 1949). Other common food items include duck potato, water lily, sedges, willow sprouts, pickerelweed (*Pontederia* spp.), and wild rice (*Zizania aquatica*) (Allen and Hoffman 1984, Edwards et al. 1992).

7. Coyote

a. Coyotes have just become established at MCB since 1995. They are known for their adaptability and have been found in a wide range of habitat. Average litter size is six. Food habits are diversified but carrion, fruit, insects, rodents, songbirds, woodchucks, rabbits, deer, and domestic animals (including pets) have all been recorded in the coyote diet. Coyotes may compete for space with other predators so may actually reduce foxes, raccoons, and feral cats.

6702. CENSUS TECHNIQUES. Carnivores are particularly difficult to census because they are elusive and highly mobile. The majority of techniques used to census furbearers result in an index rather than a true population estimate.

1. Harvest Indices. Harvest reports from licensed trappers can be used to obtain insights into general population trends (Sanderson 1987) for many furbearers. Because variables independent of population density such as pelt prices, trapper numbers, and trapper effort can influence the harvest of some species (Voigt 1987), harvest data must be used cautiously. Currently, the decline of active trapping has resulted in the fact that there is very limited harvest data available.

2. Sign Counts. This method simply entails counting tracks, droppings, or dens. Often, results are most useful in determining the presence or distribution of a species, not actual numbers. Because beaver signs such as feeding areas, dams, and lodge building are so obvious and easy to detect, survey crews can locate these activities in the field and mark maps to record the locations of beaver colonies. New technologies are allowing the use of DNA markers in droppings to be used for population sampling.

3. Calls. Sumner and Hill (1980) reported that predator calling was as effective as scent stations in eliciting responses from red and gray foxes in various habitats in Alabama. They recommended that predator calling be further investigated as a potential means of indexing populations of certain species in the Southeast. Some biologists use coyote howling to elicit responses from territorial animals during breeding season.

4. Scent Station Surveys. The scent station survey is an indirect census technique used to obtain an index of abundance of foxes and other furbearers. The relationship between population density and the rate of visitation at scent stations will vary from survey to survey due to a number of factors. The scent station technique is best suited to inventorying the predominately carnivorous furbearers.

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6703. HISTORICAL DATA

1. Beaver Populations

a. The MCBQ beaver population was censused in 1991, 1994, 1997, 2000, and 2004, using sign count techniques. All perennial and intermittent streams within MCBQ boundaries were walked and the locations of active beaver cuttings, dams, and lodges were recorded. Areas of activity were drawn onto maps and were designated as colony sites based upon geographic separation from other active beaver areas.

b. Surveys recorded 112 colonies in 1991, 111 in 1994, 124 in 1997, 126 in 2000, and 108 in 2004. A few colonies may have been overlooked by the surveys, including those around impact areas, restricted areas at Mainside (air facility and IRP sites), and beaver colonies in larger bodies of water where the absence of dams and use of bank dens made detection more difficult for volunteer survey crews. Wetlands occupied by beavers are shown at Figure 6-20.

c. From 72-86 colonies were found on the 90 miles of perennial streams at MCBQ, or 0.8 - 0.96 colonies per mile. This compares closely with the 0.8 colonies/mile reported by Buckley (1950) for New York. A maximum of 27 colonies were located on the 136 miles of intermittent streams at MCBQ (0.19 colony/mile), indicating that most intermittent streams do not have enough year-round flow to support active beaver colonies. It is believed that most suitable habitat at MCBQ may be occupied and that beaver territorial behavior may prevent much expansion of colony numbers. Beaver colonies move when they exhaust food supplies in one location, so exact colony locations shift over time. Based on an average of 5.2 beavers per colony site, the MCBQ population is estimated at over 600 animals.

d. Based on the surveys, the beaver colonies are maintaining 250-300 dams. About one-half of the colonies have typical mud and stick lodges; the other colonies maintain bank lodges. Many dams are placed within stream channels, and although water is impounded, the water is retained within the stream banks. In excess of 100 ponds have been impounded beyond the banks of the stream.

e. Beaver have modified many of the deciduous forested wetlands on Base. Through the process of tree cutting, damming, and flooding, occupied beaver sites are transformed from heavily forested riparian woodlands to open wetlands. At most older beaver sites, wetlands communities classified as palustrine scrub-shrub, palustrine emergent, and palustrine open water have been created. These beaver created habitats are significant habitats for many wetland species of wildlife, including mink, otter, raccoon, herons, waterfowl, and numerous amphibians and reptiles. Beaver cuttings have significantly thinned some woodlands around active colony sites, resulting in stimulated sprouting and understory development beneficial to woodcock, ruffed grouse and other species that require dense shrub habitat.

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f. During the 1970's and early 1980's, trappers harvested up to 50 beavers per year. These were usually taken from colonies that were close to roads and readily accessible. An adult beaver can weigh over 50 pounds and is a considerable load to carry long distances over woodland terrain. Currently, licensed trappers have little incentive to trap due to low fur prices. Licensed trappers are asked to remove unwanted beavers during open fur seasons when licensed trappers are available. Otherwise, members of the Natural Resources and Environmental Affairs (NREA) staff trap and remove the beavers from locations where they are impacting training, roads, or spillways.

2. Scent Station Surveys. Scent station surveys were conducted 8 times at MCBQ from 1983 to 2005. Results are provided at Figure 6-21. Observers had difficulty distinguishing between red and gray fox tracks, so those values were grouped into total fox tracks. The large number of foxes recorded in 1986 is believed to reflect a high population produced by the record oak mast crop of 1985. The primary trend documented was the arrival and increase of coyotes during the survey period.

3. Trapping Records

a. Trapping records are provided at Table 6-9. These figures do not necessarily reflect relative abundance between species or between years. Trapping effort is often determined by fur prices, and therefore the target species and amount of trapping effort can change from year to year. Also, access to training areas for trapping has changed from year to year, but has generally declined due to more restricted issue of range gate keys and access rights for trapping.

Table 6-9. Furbearer harvest from the 1986-2003 trapping seasons at Marine Corps Base, Quantico.

Species	Maximum Annual Harvest	Total Harvest	Average Annual Harvest
Beaver	105	343	19
Gray Fox	52	218	12
Red Fox	52	180	10
Raccoon	78	176	8
Opossum	54	100	6
Skunk	11	14	1
River Otter	4	13	1
Muskrat	2	9	1
Mink	1	1	0

4. Otter. Studies of otter home range, food habits, and population size at MCB were completed by Cogliano (2003) and Brandhagen(2003). These studies documented that otters are regular inhabitants of MCB

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watersheds. DNA studies documented a minimum of 23 individual otters on the Base in February 2001, about 1 otter per 170 acres of wetlands.

6704. MANAGEMENT PRACTICES. Furbearers generally benefit from management practices designed to improve the diversity of forests, openings, and wetland areas.

1. Wetlands. Many of the basic habitat requirements of the raccoon, muskrat, river otter and mink are provided by wetlands modified by beavers; therefore, the maintenance of a beaver population is beneficial for these furbearing species. Crayfish, frogs, fish, and other aquatic fauna in the beaver ponds provide forage for raccoons and river otters.

2. Timber Management. Management of forests should encourage a mixture of timber age classes distributed in such a way as to maximize diversity. Small, irregularly shaped clearcuts amplify edge effect and create openings that may become conducive to red foxes as well. Hard and soft mast producing species should be encouraged as they provide food for both fox species and raccoons. The retention of cavity trees, particularly in riparian zones, is recommended to provide dens for raccoons and opossums.

3. Managed Openings and Prescribed Burning. Prescribed burning in forested areas will benefit furbearers by stimulating the growth of herbaceous species that support a prey base of small rodents. Gypsy moth defoliation has also caused pockets of forest regeneration where small mammal populations have proliferated (Williams 2000).

4. Brushpiles. Brushpiles provide denning and thermal escape cover for terrestrial furbearers. Slash left from logging practices can be piled into mounds to provide shelter.

5. Harvest Management. Monitoring of harvest levels should be conducted to maintain baseline information about the presence and condition of species. Enthusiasm about commercial trapping is not expected to resume unless there is a dramatic increase in fur prices.

6. Nuisance Animals

a. Beavers. While beaver ponds are beneficial to a variety of wildlife species, the construction of dams in certain locations constitutes a nuisance. Control measures range from installing water regulatory devices to permanent removal of the dam and the beavers that built it. The installation of a PVC drain pipe is a non-lethal option that allows the beavers to remain but eliminates the flooding problems caused by their impoundments. In areas where this compromise is impractical, breaking the dam and trapping the beavers will be required.

b. Nuisance Raccoons. Raccoons frequenting garbage cans are a source of discontent for some MCBQ housing residents. Live trapping and euthanasia are recommended for the removal of problem raccoons.

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7. Sick and Dying Animals. Sick raccoons, foxes, and skunks are generally encountered several times per year at MCBQ, although some years are worse than others. Sick animals commonly have symptoms such as lack of fear, daytime activity in area frequented by humans, and weakness. Some animals may be unable to depart the area; others may be capable but reluctant. Any strange acting furbearers should be transported to the U.S. Army Veterinary Service, Fort Belvoir, for rabies testing.

6705. MANAGEMENT RECOMMENDATIONS

1. Ecology. Studies of furbearer ecology to include population densities, home range size, impacts on ground nesting birds, and disease transmission should be ongoing.

2. Permit Trapping. The MCBQ trapping program should continue to be administered by the regulations in Chapter 4 of the Fish and Wildlife Management Procedural Manual (Appendix A) and records should be kept of any furbearers taken under this program.

3. Beaver Survey. Beaver population levels should be monitored at 4-year intervals using the sign count procedure. Resulting polygons of colony locations should be entered into the MCBQ GIS to provide a historical record of beaver colonization over time.

4. Habitat. Implementation of the habitat recommendations in Section 2 of this Chapter should sustain adequate habitat for terrestrial furbearers. The beaver population will maintain a variety of wetland habitats for aquatic furbearers.

5. Beaver Culverts. The installation of perforated double cylinder beaver culverts in some dams may be used on a limited basis as a means to control water levels in some problem areas.

6. Population Controls. The dire circumstances of bobwhite quail and other ground nesting wildlife may warrant control of mammalian nest predators in quail habitat areas.

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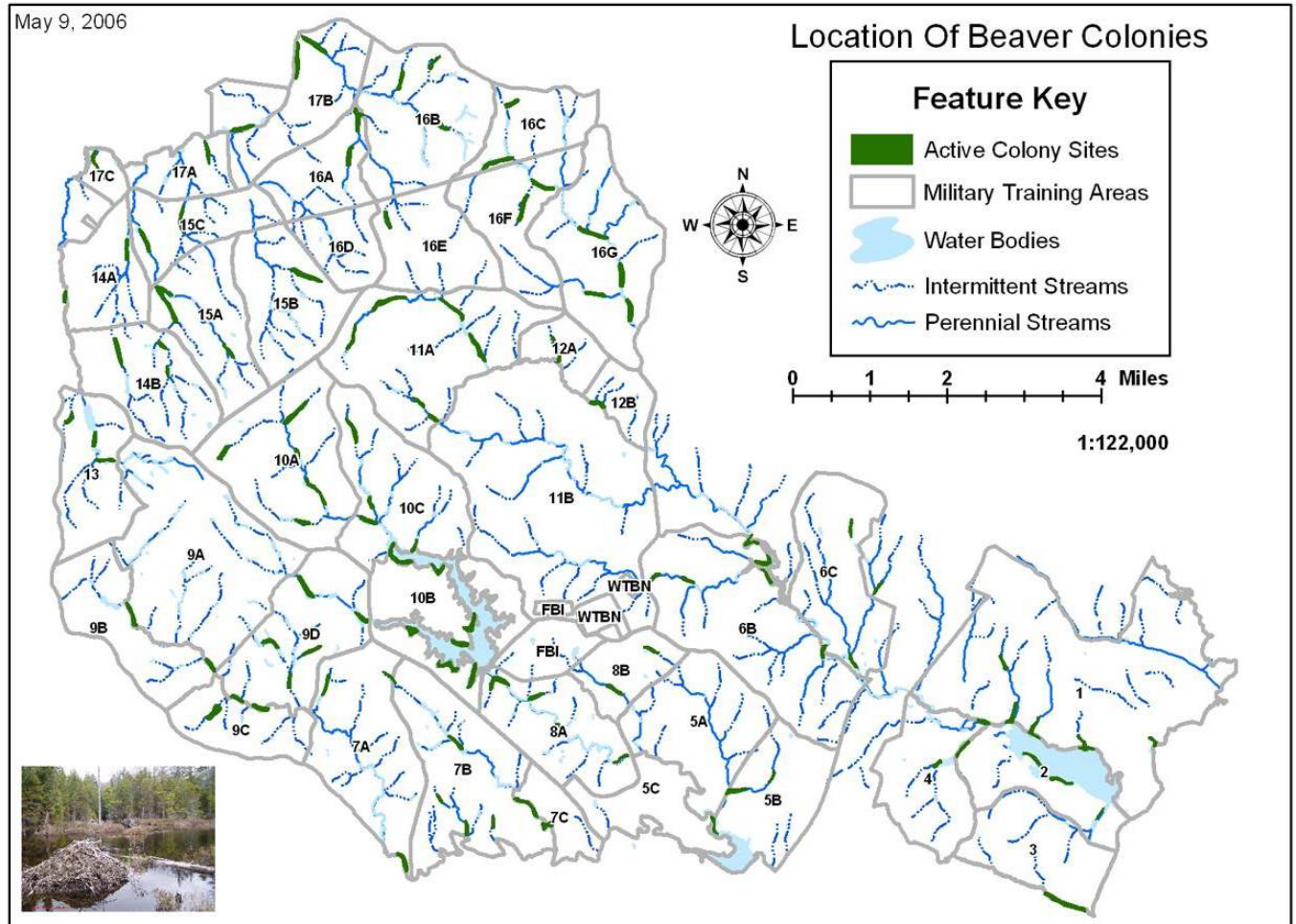
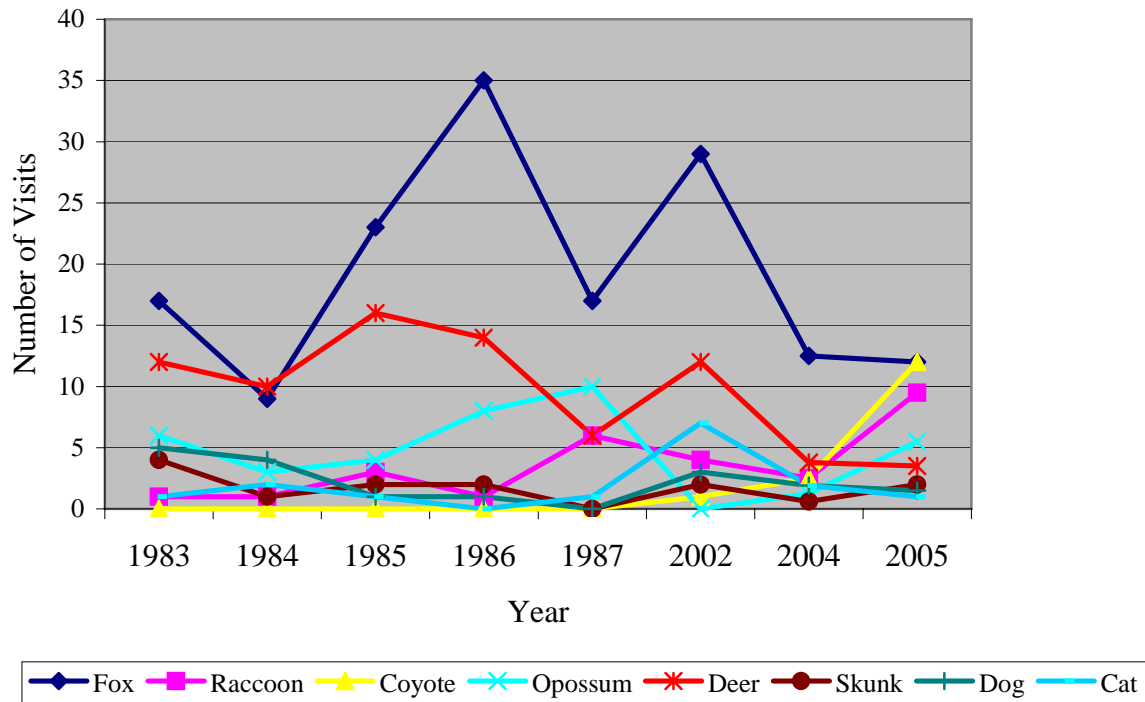


Figure 6-20.—Beaver colonies at MCB Quantico.

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Figure 6-21. October Index of Furbearer Visits per 100 Bait Stations



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CHAPTER 6

FISH AND WILDLIFE RESOURCES

SECTION 8: NONGAME SPECIES

6800. MANAGEMENT GOALS AND OBJECTIVES. Most species native to the Quantico area are not pursued for harvest under regulations governing the take of sport fishes, game animals, and furbearers, and are known as nongame species. Ecosystem management has been prescribed by DoD as the means to perpetuate all of the component parts of the biological community. The VDGIF has completed a Virginia Wildlife Action Plan which identifies the wildlife species in the Commonwealth having the greatest conservation need. Quantico will strive, to the extent practical within the military training environment, to implement land management programs that will maintain the habitat diversity required to perpetuate these species. Nongame species at Quantico occupy habitats ranging from early successional old fields to mature forest stands and various wetlands and streams. Consequently, land management at the Base must perpetuate a diversity of plant communities. This will include maintaining designated stands of mature forest, maintaining intermediate forest age classes ranging from 0 to 100+ years of age, establishing protected buffer strips in riparian habitats, maintaining wetlands, reestablishing native vegetation in previously disturbed areas, and using fire or other disturbances to maintain grassland communities. It is believed that if the species requiring the extreme habitats, i.e., fire-maintained grassland and old growth timber, are adequately supported by the land management practices used at the Base, then the more generalized species, adaptable to a wider range of vegetation conditions, will also be supported. Initiatives under the Chesapeake Bay Program to protect water quality will help maintain biological diversity in wetlands and streams. Artificial techniques, such as installing nest boxes, may be used to improve habitat for some species but the management emphasis will be on providing natural cavities.

6801. NONGAME SPECIES

1. Birds

a. A Checklist of Birds for MCB, Quantico, is provided at Appendix D. This checklist was compiled from observations made by northern Virginia bird clubs affiliated with the Virginia Society of Ornithology. Information taken from Christmas Bird Counts conducted by the Nokesville Bird Club were important for indicating the common winter birds found on the western portion of the Base. The checklist was also edited by the Base wildlife staff to include their recent observations about species abundance. Common woodland species include the blue jay (*Cyanocitta cristata*), Carolina chickadee (*Parus carolinensis*), tufted titmouse (*P. bicolor*), red-bellied woodpecker (*Melanerpes carolinus*), downy woodpecker (*Picoides pubescens*), Carolina wren (*Thryothorus ludovicianus*), wood thrush (*Hylocichla*

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mustelina), and red-eyed vireo (*Vireo olivaceus*). Species found in openings and edge habitats include the mockingbird (*Mimus polyglottos*), brown thrasher (*Toxostoma rufum*), eastern bluebird (*Sialia sialis*), American crow (*Corvus brachyrhynchos*), indigo bunting (*Passerina cyanea*), prairie warbler (*Dendroica discolor*), song sparrow (*Melospiza melodia*), yellow-breasted chat (*Icteria virens*), and white-throated sparrow (*Zonotrichia albicollis*). The wood thrush, red-eyed vireo, indigo bunting, prairie warbler, and yellow-breasted chat are among the neotropical migratory bird species that breed at Quantico. Populations of many of these migratory species appear to be declining and, therefore, are the subject of a nationwide conservation program, "Partners in Flight."

b. Common wetland and aquatic species include the double-crested cormorant (*Phalacrocorax auritus*), great-blue heron (*Ardea herodias*), green heron (*Butoroides striatus*), belted kingfisher (*Megaceryle alcyon*), and a variety of waterfowl (see Section 3, Chapter 6). Congregations of over 50 great blue herons can often be seen feeding in the shallow tidal flats of Chopawamsic Creek. A large heron rookery is located in the wetlands of the lower Chopawamsic Creek.

c. The most common birds of prey observed or heard at MCBQ include the bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), red-tailed hawk (*Buteo jamaicensis*), red-shouldered hawk (*B. lineatus*), broad-winged hawk (*B. platypterus*), sharp-shinned hawk (*Accipiter striatus*), American kestrel (*Falco sparverius*), turkey vulture (*Cathartes aura*), black vulture (*Coragyps atratus*), barred owl (*Strix varia*), and great horned owl (*Bubo virginianus*). The tidal waters of Chopawamsic Creek provide important foraging habitat for osprey that nest along adjacent waters in the Potomac River and Quantico Creek. As many as 32 osprey have been counted at one time feeding in these wetlands during herring and shad runs in April and May. Ospreys are a common nesting species on buoy markers in the Potomac River but also nest on communication towers, ball field lights, and power poles.

2. Mammals. A listing of mammals found at MCBQ is shown at Appendix D. The list was refined in 1992 by drift fence samples collected by the Virginia Natural Heritage Division (VDCR 1992) and by small mammal habitat studies (Williams 2000). Common small mammals include the eastern mole (*Scalopus aquaticus*), least shrew (*Cryptotis parva*), northern short-tailed shrew (*Blarina brevicauda*), eastern chipmunk (*Tamias striatus*), white-footed mouse (*Peromyscus leucopus*), meadow vole (*Microtus pennsylvanicus*) and woodland voles (*Microtus pine-torum*). One specimen of the star-nosed mole (*Condylura cristata*) was found in drift fence samples; in Virginia it is listed as a State Species of Concern per the Virginia Wildlife Action Plan.

3. Reptiles and Amphibians

a. A list of MCBQ amphibian and reptiles is provided at Appendix D. This list was compiled by Dr. Joe Mitchell during 1990-1991 surveys (VDCR 1992) and was further refined by pitfall trapping done by Williams (2000) and Mitchell (1998). Species were collected and

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identified through intensive searches, call counts, drift fences/pitfall traps, dipnets, turtle traps, and minnow traps. Most individuals were collected or sighted in mesic forest and floodplain habitats, suggesting that these habitat types are critical to the maintenance of amphibian diversity at MCBQ.

b. The known reptile fauna of MCBQ consists of 24 species, and the expected number is 35 (VDCR 1992). During the VDCR study, five of the expected 6 species of lizards, 5 of the 9 species of turtles, and 12 of the 20 expected species of snakes were confirmed. Since that study, the smooth earth snake (*Virginia valeriae*) and the spotted turtle (*Clemmys guttata*) have been confirmed on the Base (T. Stamps pers. comm.). The spotted turtle and box turtle are considered DGIF Action Plan Tier III species (high conservation need).

c. Based on drift fence samples, the areas of greatest herpetofaunal diversity at MCBQ appeared to be mesic, forested floodplains and mature hardwood forests. Mitchell (1998) and VDCR (1992) strongly recommended that these habitats be maintained as much as possible in their natural state. He suggested that they should not be converted to pine monocultures, which would provide habitat for few amphibians.

4. Fish. Nongame fish species within MCBQ watersheds were identified by surveys conducted by the U.S. Fish and Wildlife Service and George Mason University (see Section 1, Chapter 6, page 6-10). Forty species were identified and are listed at Appendix D. Recommendations for management included the continuing protection of water quality and improvement of stream crossings in the training areas.

5. Invertebrates

a. In 1990-1991, Base watersheds were surveyed for the presence of rare mussels and the federally listed dwarf wedgemussel was found in Aquia Creek (see Chapter 7).

b. Lepidoptera (butterflies and moth) surveys were conducted on Base in 1998 and 1999 (Chazal 2000). The diversity, complex life, cycle, and sheer numbers of Lepidoptera make them an important component of ecological systems as pollinators, prey and primary consumers. Sixty-one species of butterflies and 301 species of moths were identified (Appendix D). No rare species were found but a number of county occurrence records were made. The habitats with the highest number of species were bottomland forest, native grasslands, and mixed-upland forests.

c. Benthic macroinvertebrates were studied at 13 stream sites at MCBQ in 1998 and 1999 (Kelso et. al. 2000). The most numerous insect order was Diptera, with substantial numbers of midges, blackflies, and craneflies detected. Mayflies (Ephemeroptera) were the second most numerous insect. Other important insects found, in decreasing order of abundance, were caddisflies (Trichoptera), stoneflies (Plecoptera), beetles (Coleoptera), hellgrammites (Megaloptera), dragonflies (Odonata), and true bugs (Hemiptera). Most Base streams had an Index

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of Macroinvertebrate Integrity (IMBI) ranking of "non-impaired". Plafkin et. al. (1989) described non-impaired as "comparable to the best situation to be expected within an ecoregion."

6802. SPECIES GROUPS AND HABITAT REQUIREMENTS. It is not necessary to identify a habitat management program for every species. Rather, it is appropriate to develop habitat management programs that meet the requirements of groups of species that have similar life requisites. For the purposes of this plan, the following groups have been identified: cavity nesting birds, neotropical migratory birds, grassland and forest edge birds, amphibians, small mammals, lepidoptera, and aquatic invertebrates. Within these groups are species that rely on the extreme of habitats found at Quantico: stream corridors, grasslands, forest edges, and mature closed canopy forests.

1. Cavity Nesting Birds

a. Woodpeckers, nuthatches, chickadees, bluebirds, kestrels, and barred owls and bats are a few examples of species that require nesting cavities to satisfy their life requisites. Bluebirds and kestrels are found on the edges of open habitats. Small birds such as nuthatches and chickadees can find cavities in a variety of intermediate aged forest habitats. The pileated woodpecker and barred owl, however, are large birds that require expansive forested areas that contain large trees that provide cavities suitable for security and reproduction (Schroeder 1982, Allen 1987). In all probability, if the habitat requirements of the pileated woodpecker and barred owl are met, the life requisites of other woodland cavity-nesting species will also be met.

b. MCBQ forest stand inventory data collected during 1991 and 1992 were used to calculate habitat values used in U.S. Fish and Wildlife Service Habitat Suitability Index (HSI) Models for these species (Prose and Cade 1993). Results of the evaluation were described in a previous version of this INRMP (MCB 1997). The findings concluded that hardwood (HMHD), mixed pine-hardwood, and non-mast hardwood timber stands provided about one-half optimum habitat value at 40 years of age and gradually increased to optimum habitat conditions at 100 years of age. Land management zones 2-6, which have limited access and are not subject to regular timber harvest, should provide optimum habitat for these species and others that require extensive closed canopy mature forest. Land management zone 1, which is subject to regular planned timber harvest, will normally have at least 50% of the acreage in forest ranging from 40-100 years of age. This zone should also accommodate these species but will perhaps be at a lower population density.

c. Nesting boxes for the eastern bluebird and kestrel have been installed along forest edge and grassland habitats. The Conservation Volunteer Program manages about 50 bluebird boxes in training areas west of Interstate 95 and the Northern Virginia Bluebird Society installed a bluebird trail along the Medal of Honor golf course at

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Mainside. The kestrel boxes, installed as a Boy Scout project, have not been maintained and should be refurbished.

2. Neotropical Migratory Birds

a. Neotropical migratory birds breed in North America and migrate to Central and South America to overwinter. Population indices for many of these species have declined in recent years, focusing national attention on the status of these species. The Partners in Flight (PIF) program evolved as a nationwide program to study and manage these species. The Department of Defense (DOD), Department of Navy, and U.S. Marine Corps are active participants in this program.

b. DOD goals and objectives for neotropical migratory bird management (DOD 1994) are to:

(1) Facilitate cooperative partnership efforts in consonance with the requirements of the military mission.

(2) Determine the current status of neotropical bird populations on DOD lands and the causes of population fluctuations.

(3) Identify and maintain priority habitats on DOD lands for neotropical migratory bird populations.

(4) Use information collected from this partnership program to better support DOD mission requirements.

(5) Take proactive management actions to prevent neotropical migratory birds from reaching threatened or endangered status.

c. The wood thrush, scarlet tanager, and red-eyed vireo are common neotropical migrants found in mature MCBQ woodlands. Much research is ongoing nationwide to determine the factors affecting the population densities and breeding success of these species. Under the Legacy Resource Management Program, MCBQ hosted research concerning reproductive biology and landscape level habitat relationships of these species (Vega-Rivera 1997, Penhollow and Stauffer 2000). In 1995, MCB enrolled three bird-banding stations in the Monitoring Avian Productivity and Survival (MAPS) program and has been operating those stations annually. In 2000, a two-year study involving the feeding ecology of neotropical birds during the fall migration was initiated (Figure 6-21).

3. Edge Species. Some year-round resident and migratory bird species use open grassland and woodland edges. Among the nongame birds utilizing these habitats are the eastern bluebird, American robin (*Turdus migratorius*), cardinal, indigo bunting (*Passerina cyanea*), yellow-breasted chat, prairie warbler, eastern phoebe (*Sayornis phoebe*), and song sparrow. Native grasses and shrubs should be encouraged along edges, and the openings should contain structural features such as downed logs and perch sites. Forest openings created by clearcuts are usually colonized by native grasses prior to canopy closure. Therefore, carefully planned timber harvesting operations

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can be supportive of non-game birds that require early successional habitats. It is important that timber harvests are planned and scheduled over time so that adequate mature timber is retained to meet the requirements of the larger cavity-nesting species but that some cutover habitat exists to support early successional species. Fire-maintained landscapes at MCBQ support a diverse assemblage of bird species as documented by LeClerc and Paxton (2004).

4. Wetland Species. The diversity of wetland habitats present at MCBQ (described in Chapter 2) provide habitat for a variety of nongame species. Amphibians have recently received considerable media and scientific attention because of species extinctions and population declines worldwide. Because amphibians rely on shallow wetlands for the reproductive portion of their life cycle, their population status should closely relate to the quality and availability of wetland habitats. As a result of a DOD Legacy Resource Management Program sponsored mid-Atlantic regional study, it was determined that amphibian populations at MCBQ are currently stable (Mitchell 1998).

5. Small mammals. Williams (2000) conducted studies at MCBQ to determine whether the abundance, species composition, density, survival, and reproductive effort of small mammals varied with respect to forest cover type. Catch per unit effort was greatest in shelterwoods followed by riparian, clearcut, and mature forest types. The results of the study suggest that current even-aged forest management practices at MCB are compatible with the maintenance of native populations of small mammals. Disturbances created by harvesting, at least temporarily, resulted in favorable microhabitat conditions for a variety of small mammals.

6803. MANAGEMENT RECOMMENDATIONS

1. Forest Landscapes. Recent studies by Welsh and Healy (1993) suggest that in extensively forested areas, timber management, and maintenance of the native breeding forest songbird community can be compatible. On their study area, 50% of the area was in forest reserve not under active timber management. The other 50% of forest-land was under active timber management being harvested by clear-cutting or shelterwood methods on an 80 year rotation. This practice provided large areas of mature timber but also provided seedling and edge habitat for species that required early successional habitats. The forest habitat management program prescribed in Section 2 of this Chapter is very similar and should accommodate species requiring both young forest stands and extensive mature forested habitats.

2. Open Landscapes. Species adapted to open landscapes include the American kestrel, killdeer, kingbirds, purple martin, barn swallow, meadowlarks, a variety of sparrows, and meadow voles. The promotion of native grasses in managed open fields and maintenance of transitional zones along forest edges is recommended. The prescription of fire in Section 2 along with other maintenance practices to increase the acreage of grasslands should be of benefit to these species.

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3. Edge Habitats

a. Edges and their ecotones (the area influenced by the transition between plant communities) are frequently rich in wildlife, both in numbers of species and individuals, because of the additive effect created when two or more plant communities and structural conditions come together. The management of openings and even-aged forest management prescriptions in Section 2 will ensure that edge habitats are relatively abundant in land management zone 1 where timber harvests are scheduled. Infrequent forest disturbances, insect disease, storms and fire may less predictably create edge habitats in the land use zones 2-6.

b. Transitional landscapes offer the opportunities for habitat improvement in urban areas. Birds commonly attracted to wood margins, shrub thickets, and other edge habitats include doves, hummingbirds, wrens, mockingbirds, bluebirds, thrashers, cedar waxwings, orioles, cardinals, indigo buntings, and several species of warblers and sparrows. Many of these species nest in woodlands but feed heavily along edges because of the generally high production of seeds, fruits, and insects within this transition zone. The Virginia Department of Game and Inland Fisheries and National Wildlife Federation can provide information about backyard habitat programs. This should be made available for schools and civic groups aboard the Base that would like to do conservation projects in the housing and developed areas.

4. Riparian Corridors. The control of non-point source pollution and maintenance of vegetated buffer strips along streams and other watercourses is essential for the maintenance of healthy amphibian populations and aquatic systems. These riparian zones are extremely beneficial to non-game wildlife and are also important for erosion control, bank stabilization, and maintaining water quality (see Chapter 4).

5. Pesticide Use. Because a variety of insects, including moths, butterflies, and benthic macroinvertebrates are important as pollinators and/or prey, caution must be exercised in the use of pesticides. These invertebrates are important in the food chains of aquatic and terrestrial vertebrates. The majority of forest-dwelling bird species are insectivorous and require a constant food supply to feed nestlings and store fat for migration; pesticides must be used judiciously so as not to eliminate their food supply. Integrated Pest Management programs for control of pests such as the gypsy moth are described in Chapter 5 and attempt to balance ecosystem risks.

6. Nesting Structures. Under natural conditions, cavities in live trees and snags usually provide preferred homes for cavity-nesting species. It is seldom practical to leave diseased trees standing where they can become a potential hazard in residential neighborhoods, or high-use recreation areas. Therefore, providing artificial nest structures may be the best way to encourage cavity-nesters in some environments. Nest boxes are recommended for greenspace management and their construction often lends itself to community projects undertaken by scouting groups and other civic organizations.

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Continuation of the bluebird nest box program and restoration of the kestrel nest box program is recommended.

7. Research and Surveys

a. Short and long-term surveys should be supported to improve knowledge about nongame species distribution and response to land management actions.

b. Support DOD PIF program by continuing support for studies involving ecology of neotropical migratory birds. Continue the operation of three MAPS stations.

c. Evaluate the Virginia Wildlife Action Plan and identify species of greatest conservation concern that occur at Quantico. Develop monitoring programs for these species.

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Figure 6-22.--Ecological research projects: (top) stream electroshocking to monitor fish populations; (lower right) radio-monitoring wood thrush dispersal movements; (lower left) mist-netting and leg-banding migratory birds to determine reproductive success, migratory movements and feeding ecology.

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CHAPTER 6

FISH AND WILDLIFE RESOURCES

SECTION 9: SUMMARY AND WORK PLAN

6900. SUMMARY

1. The chapter has identified a wide range of species and their habitat requirements, reviewed literature pertinent to maintaining viable populations, and recommended management projects that are compatible with the military mission and other land use objectives.
2. Fisheries management recommendations include continuing coordination with the Virginia Department of Game and Inland Fisheries (VDGIF) to sample fisheries populations in small ponds and impoundments; continuing the put-and-take trout fishing program and developing a delayed harvest trout stocking program; ensuring that fishing access is maintained at ponds and impoundments; maintaining dams of small impoundments by brush clearing, maintenance and construction of proper emergency spillways; protecting water quality by control of nonpoint source sedimentation pollution by adherence to Virginia Best Management Practices for land disturbing activities; and maintaining habitat structures in the major impoundments.
3. Terrestrial habitat management focuses on maintaining habitat for grassland species, early successional forestland species, and species that require larger blocks of closed canopy mature forest. Guidelines include maintaining 50% or more of forest compartments in timber ≥ 40 years of age to promote hard mast production; scattering small forest regeneration units (< 25 acres) among older forest stands; managing riparian zones to protect water quality, provide large snags and den trees, and provide small pockets (< 5 acres) of early successional forest; maintaining remnant fruit and nut tree orchards at old home-sites; maintaining 2% or greater of habitat in managed openings; planting managed openings on a rotational cycle to enhance nutrition and cover values for wildlife; coordinating conservation plantings with military training, right-of-ways maintenance, sludge application, and forestry operations to optimize multi-purpose use of open lands; using prescribed burning to promote habitat values for grassland species; and controlling the spread of non-native plants such as tall fescue and autumn olive.
4. Waterfowl/wetlands management recommendations include promoting wetlands conservation by implementing the Department of Navy "no-net loss" wetlands policy; maintaining the beaver population at a desirable level; and controlling damage caused by resident Canada geese.
5. Population monitoring surveys for wild turkey, bobwhite quail, cottontail rabbit, white-tailed deer, beaver, waterfowl and migratory birds would be continued or expanded. Studies of predator/prey ecology are recommended. Wildlife disease surveillance in support of

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the Virginia Department of Game and Inland Fisheries (DGIF) chronic wasting disease and avian influenza monitoring programs will be done as requested by the DGIF. Consideration will be given to research, monitoring and conservation measures that can be taken for species of conservation concern identified in the Virginia Wildlife Action Plan.

6901. FIVE-YEAR WORK PLAN. The proposed five-year work plan and budget estimate for fish and wildlife resources management is shown at Table 6-9. The table does not include labor costs for federal employees in the overall budget. Dollar value estimates are for the costs of materials, supplies, equipment, and contracts. Projects to repair and maintain structures such as dams and spillways are listed in Table 8-2, Chapter 8.

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Table 6-9. Budget and time line for fish and wildlife management projects. Priority (PRTY) "A" projects maintain the existing program. Priority "B" and "C" projects add additional projects to provide a more comprehensive program. ¹ Project fund sources are provided in ().						
DRIVER, GOAL, PROJECT	PRTY	Estimated annual cost in \$1,000 increments				
		2007	2008	2009	2010	2011
II. To support and enhance the preservation of all animal and plant life endemic to the Base ecosystem.						
1. Goal: To provide for the stewardship of fish and wildlife resources by managing the soil, water, vegetation and other natural features to sustain and ensure for future uses quality habitats and diversified biological communities.						
<ul style="list-style-type: none"> Participate in NEPA review of land disturbing projects to evaluate impacts on fish and wildlife populations. 	A	*	*	*	*	*
<ul style="list-style-type: none"> Use agronomy practices to establish and maintain about 150 acres per year of crops/grasslands to support military training, wildlife habitat, soil and water conservation, and recreation. (\$30K is FEFV; \$20K is H6A15) 	A	50	50	50	50	50
<ul style="list-style-type: none"> Promote recreational fisheries by placement of habitat structure in Lunga Reservoir, Breckinridge Reservoir and Dalton Pond. (H6A15) 	A	2	2	2	2	2
<ul style="list-style-type: none"> Protect aquatic habitat by point and non-point source pollution abatement (see Chapter 4). 	A	-	-	-	-	-
<ul style="list-style-type: none"> Maintain walnut and fruit trees in old homesites for aesthetic values, and hard/soft mast production. (H6A15) 	A	1	1	1	1	1
<ul style="list-style-type: none"> Use prescribed burning to maintain grassland habitat in conjunction with military range management and other land uses. (H6A15) 	A	2	2	2	2	2
<ul style="list-style-type: none"> Install artificial nest boxes for bluebirds, kestrels, wood ducks, and other wildlife where appropriate. (H6A15) 	A	1	1	1	1	1
<ul style="list-style-type: none"> Plant impoundment shorelines with moist soil plants during summer draw downs when feasible. (H6A15) 	B	1	1	1	1	1
<ul style="list-style-type: none"> Increase land clearing and agronomy practices to treat 250 acres per year. (FEFV) 	B	50	50	50	50	50
<ul style="list-style-type: none"> Cooperate with power companies and VDGIF to convert vegetation on transmission right-of-ways to warm season grasses. (FEFV) 	B	10	25	0	0	0
<ul style="list-style-type: none"> Increase agronomy practices to treat 350 acres per year. (FEFV) 	C	100	100	100	100	100
4. Goal: To professionally monitor projects and programs, and directly or indirectly, gather data beneficial to the						

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Table 6-9. Budget and time line for fish and wildlife management projects. Priority (PRTY) "A" projects maintain the existing program. Priority "B" and "C" projects add additional projects to provide a more comprehensive program. ¹ Project fund sources are provided in ().						
DRIVER, GOAL, PROJECT	PRTY	Estimated annual cost in \$1,000 increments				
		2007	2008	2009	2010	2011
II. To support and enhance the preservation of all animal and plant life endemic to the Base ecosystem.						
conservation and management of fish and wildlife.						
<ul style="list-style-type: none"> Conduct acorn count per VDGIF protocol to monitor this important wildlife food source. 	A	*	*	*	*	*
<ul style="list-style-type: none"> Survey Base impounded waters to maintain database of game fish populations 	A	#*	#*	#*	#*	#*
<ul style="list-style-type: none"> Conduct turkey spring gobbler index count and compile summer brood observations. 	A	*	*	*	*	*
<ul style="list-style-type: none"> Collect deer and wild turkey data at Game Checking Station and maintain electronic database to assess long-term population trends. 	A	*	*	*	*	*
<ul style="list-style-type: none"> Conduct quail/rabbit route for annual VDGIF survey. Conduct base-wide call routes to map quail presence/absence. 	A	*	*	*	*	*
<ul style="list-style-type: none"> Deer population counts. Conduct snow track and post-hunt night-lighting surveys to provide index of deer herd sizes. 	A	*	*	*	*	*
<ul style="list-style-type: none"> Beaver Census. Conduct beaver inventory every four years. 	A		*			
<ul style="list-style-type: none"> Support nationwide Partners in Flight by operating three stations to monitor avian productivity and survival (MAPS). (FEFV) 	A	12	12	13	13	14
<ul style="list-style-type: none"> Monitor the relative abundance and distribution of submerged aquatic vegetation in tidal waters and impoundments. (FEFV) 	B	*		*	*	*
<ul style="list-style-type: none"> Maintain a weed management information system to update location maps and control efforts involving invasive plant species. (FEFV) 	A	5	5	5	5	5
<ul style="list-style-type: none"> Ecosystem Studies. Sponsor research to monitor the impact of on and off-Base actions, including predation, on regional ecosystems. (FEFV) 	B	40	80	40	40	40
<ul style="list-style-type: none"> Fishing Creel Survey. Conduct field interviews and creel checks to evaluate the utilization of Base waters and angling success. (H6A15) 	B	0	0	0	0	*
<ul style="list-style-type: none"> Furbearer Scent Station Index. Operate 100-station route annually 	B	*	*	*	*	*

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Table 6-9. Budget and time line for fish and wildlife management projects. Priority (PRTY) "A" projects maintain the existing program. Priority "B" and "C" projects add additional projects to provide a more comprehensive program. ¹ Project fund sources are provided in ().						
DRIVER, GOAL, PROJECT	PRTY	Estimated annual cost in \$1,000 increments				
II. To support and enhance the preservation of all animal and plant life endemic to the Base ecosystem.		2007	2008	2009	2010	2011
to maintain index of mammalian predator populations.						
• Provide support for DGIF wildlife disease monitoring programs.	A	*	*	*	*	*
• Develop monitoring programs for wildlife species of greatest conservation concern as ranked in the Virginia Wildlife Action Plan. (FEFV)	B	5	10	10	10	10
5. Goal: To control damage to human health, property, or natural communities by controlling damage due to the overpopulation or encroachment of flora and fauna.						
• Use integrated pest management control practices to control phragmites, tall fescue, autumn olive or other invasive plant species. (FEFV)	A	25	25	25	25	25
• Apply lethal and non-lethal controls approved by USDA APHIS, VDGIF, and permitted by the USFWS to reduce/control resident goose, gull, and vulture populations near administrative, recreational, and air facilities (BASH). (FEFV)	A	15	15	15	15	15
• Apply lethal and non-lethal control measures approved by USDA APHIS and VDGIF to reduce/control property damage, predation, disease, or other problems caused by furbearing mammals. (H6A15)	A	1	1	1	1	1
• Install deer bait stations to transmit acaricide (tick pesticide) to a sample area of the Base. The purpose is to reduce tick populations and reduce health risks and discomfort due to tick bites and tick-borne diseases. (FEFV)	C	50	50	50	50	50
Subtotal for "A" projects		114	114	115	115	116
Subtotal for "B" projects		106	166	101	101	101
Subtotal for "C" projects		150	150	150	150	150
Grand Total		370	430	366	366	367

¹Primary funding sources for the projects are H6A15 (fish and wildlife fee account) and FEFV (O&M, MC conservation). An itemized list for different funding sources is provided at Table 10-1.

*Projects costs are mostly labor related.

#VDGIF provides assistance.

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